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POLICY RESEARCH WORKING PAPER

Patterns of Economic Growth

Hills, Plateaus, Mountains, and Plains

Lant Pritchett

The recent “growth” literature has underestimated the importance — and ignored the implications — of the instability and volatility of growth rates. In particular, the use of “panel” data to investigate the effects of long-term growth in developing countries — especially with “fixed effects” estimates — is potentially more problematic than helpful.



Summary findings

Except during the Great Depression, the historical path for per capita GDP in the United States has been reasonably stable exponential trend growth, with modest cyclical deviation. Graphically, growth in the United States displays as a modestly sloping, only slightly bumpy, hill. But almost nothing that is true about per capita GDP for the United States (or for other OECD countries) is true for developing countries.

First, per capita GDP in most developing countries does not follow a single time trend: For a given country, there is great instability in growth rates over time, relative to both average level of growth and to cross-sectional variance.

These shifts in growth rates lead to distinct patterns. Some countries have had steady growth (hills and steep hills); others have had rapid growth followed by stagnation (plateaus); others have had rapid growth followed by declines (mountains) or even catastrophic declines (cliffs); still others have experienced continuous

stagnation (plains) or even steady decline (valleys).

Second, volatility — however measured — is much greater in developing than in industrial countries.

These stylized observations about growth rates, Pritchett concludes, suggest that it may be useless to use “panel data” to investigate long-term growth rates in developing countries. Perhaps more can be learned about developing countries by investigating what initiates (or halts) episodes of growth.

There is something of a professional split in “growth” literature, Pritchett observes. Macroeconomists studying industrial countries discuss steady-state growth and ponder whether all countries in the “convergence club” will reach the same happy level in the end. Development economists, on the other hand, are the pathologists of economics, having discovered that developing countries are most emphatically not all alike. Developing countries have found ways to be ecstatic but they have also discovered many different ways to be unhappy.

This paper — a product of the Development Research Group — is part of a larger effort in the group to understand the determinants of economic growth. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact Sheila Fallon, room MC3-638, telephone 202-473-8009, fax 202-522-1153, Internet address sfallon@worldbank.org. The author may be contacted at lpritchett@worldbank.org. July 1998. (40 pages)

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Patterns of Economic Growth: Hills, Plateaus, Mountains, and Plains*

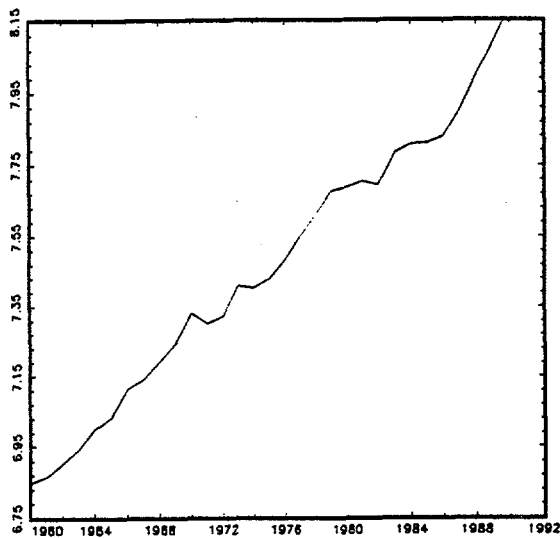
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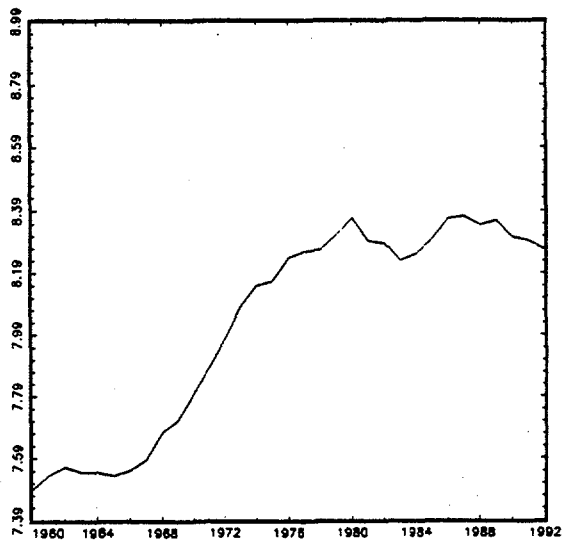
Patterns of Economic Growth: Hills, Plateaus, Mountains, and Plains

"Happy families are all alike; every unhappy family is unhappy in its own way"
Leo Tolstoy

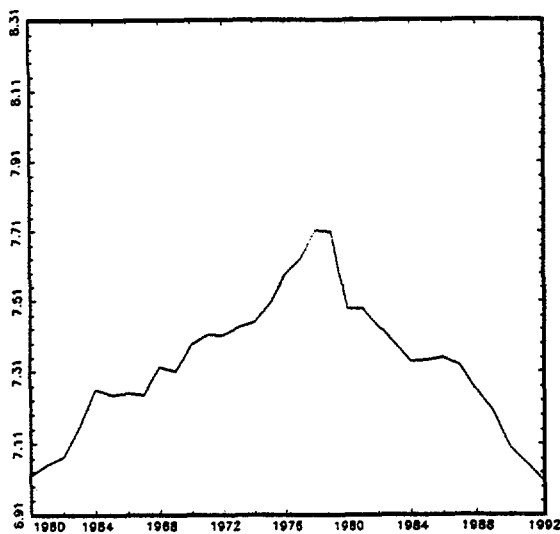
Thailand's GDPPC, a (steep) Hill



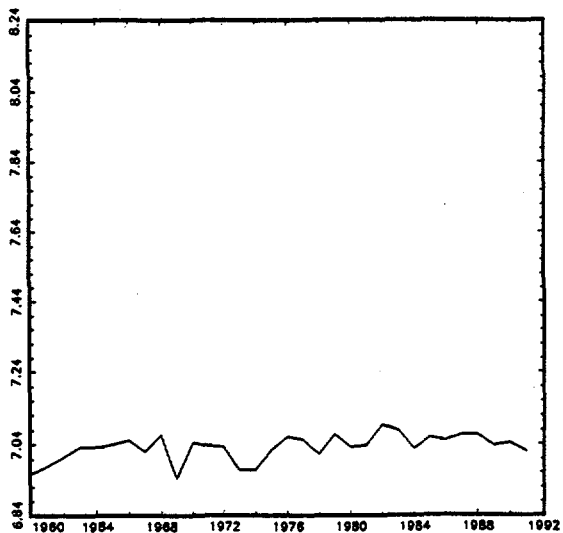
Brazil's GDPPC, a Plateau



Cote d'Ivoire's GDPPC, a Mountain



Senegal's GDPPC, a plain



Patterns of Economic Growth: Hills, Plateaus, Mountains, and Plains

Introduction

The aspect of economic growth that makes it “hard to think about anything else” (Lucas, 1988) are large and persistent differences in growth rates across countries¹. The power of compound interest turns even smallish growth differences sustained over long periods into huge shifts in living standards, and largish growth differences into seismic shifts. According to Maddison’s data from 1870 to 1980 the USA grew at 1.84 percent per annum, Great Britain grew at 1.24 percent per annum, and Japan grew at 2.64. The cumulative effect of a .6 of a percentage point lag in growth versus the USA saw Great Britain go from *the* economic superpower to playing catch up. The cumulative effect of Japan’s .8 percentage point growth edge over the USA transformed Japan from backwater to economic superpower. With its 1.4 percent edge in growth, Japan went from having only fifth of Great Britain’s per capita income to equality. The recent huge growth spurts of some East Asian countries, sustained over several decades, have changed have the global economic map.

However, this fixation on differences in long-run (even possibly steady state) differences in growth in the theoretical and empirical research explaining growth has led to an underestimation of the importance of the *instability* and *volatility* in growth rates, especially in the developing countries. Is explaining Brazil’s “growth” explaining the 4.2 percent (all

¹ Of course, if one divides macro phenomena into “trend” and “cycle” and is convinced that business cycle fluctuations are voluntary reallocations of factors, including labor supply, across periods, so that cycles have little or no welfare consequences, then obviously the “trend” is all that is left for macro economists think about.

growth rates are per capita per annum) growth from 1965 to 1980 or explaining the stagnation from 1980 to 1992 (actually a slight fall of -.2 percent) or explaining Brazil's *average* growth percent from 1960-92 of 3.14?

From 1960 to 1980 Cote d'Ivoire grew at 3.1 percent, something of an African growth miracle, while from 1980 to 1992 GDPPC in Cote d'Ivoire *fell* at 4.1 percent, a growth disaster. Its average growth for the entire period was .22 percent. Nearby Senegal grew very steadily, but very very slowly, at the nearly identical average growth rate of .18 percent. What is the relevant sense in which the "growth" experience of Senegal and Côte d'Ivoire explained by growth theory or empirics was the same?

In addition to instability in growth rates in the developing countries there is enormous *volatility* in output. While in developed economies that ratio of the standard deviation of natural log first differences is about 1, so annual fluctuations are about equal in magnitude to trend growth, in a typical developing economy this ratio is four times as high. This combination of instability and volatility makes it difficult to separate "long-run" growth from exogenous shocks, business cycles, or transitional growth due to changes in levels.

This paper has two linked halves. The first part is entirely descriptive and provides a set of non-standard summary statistics characterizing the evolution of GDP per capita for a broad cross section of countries, with particular emphasis on going beyond average growth rates to instability in growth rates and the volatility of output. The second half of the paper discusses the implications for recent econometric research. The use of "panel" data, particularly with "fixed effects" to investigate long-run growth effects is almost certainly pointless.

Suggestions for future growth research into the determinants of *shifts* in growth rates by focusing on episodes concludes the paper.

1) Data and Methods

The output variable used throughout is RGDPCH (denoted GDPPC or simply y for its natural log) the chain linked index of real GDP per capita measured in 1985 purchasing power parity dollars from the Penn World Tables Mark 5.6². I use data from 1960 (data prior to 1960 was dropped to maintain cross-national comparability) to the last available date, using only those with at least 25 years of data, which leaves 111 countries. The final year of the data varies from 1985 to 1992, and so will be referred to as the “most recent.”

Statistics are calculated for three aspects of growth for each country: levels, instability, and volatility. The procedures for each of these are described in table 1. First are the basic statistics on the level of income and growth rate (unless otherwise noted all subsequent references to “growth” refer to least squares growth rates) over the whole period and sub-periods. Calculated are: initial income, final income, average annual growth based on end points, and the ratio of final income to the maximum and to the minimum income.

The second set are statistics on the instability of growth, changes in growth rates within a country. The single best year to break the trend into two parts is chosen by minimizing the SSE from doing so, similar to an analysis of Ben David and Papell (1997). This procedure is

² Although almost certainly none of the results about *growth* and its characteristics would differ much if I had used the World Bank’s national accounts data on real per capita GDP in local currency constant prices. The PWT5.6 provide information about the *level* of GDPPC in comparable terms, but since for nearly all developing countries there are few benchmark points nearly all the time series content is straight from the World Bank data.

used to calculate the year of the break in trend and the growth rate before, the growth rate after and the difference between the growth rates.

The third set are statistics on the volatility of output. Here the procedures are based on three different aspects of the time series; the deviations from a single trend; the variability of first differences and the magnitude of second differences; the forecast ability of the time series based on a rolling trend calculated with a fixed length of past data.

Due to the cross-national distribution of the data I will, in most of the summary discussions, use robust statistics: the median as a measure of central tendency and the rank (not simple) correlation as a measure of association. The summary statistics results are calculated separately for the developing (or equivalently and noted honestly, LDC) and developed countries.

Membership in the OECD (before any recent expansion) is the criteria for “developed” while “developing” are the rest. Although it is mostly standard, my classification does require some discussion on two points. The minor point is that I include two Mediterranean Islands, Malta and Cyprus, in the “developed” category even though they are not part of the OECD and that I exclude Turkey even though it is. The major point is that this definition of “developed” does not correspond to an income ranking. It differs from the World Bank’s “High Income” category by consistently excluding oil producers (e.g. Kuwait, Saudi Arabia) and by not adding new entrants as they pass an income threshold, (e.g., Singapore and Hong Kong). If countries are classified by income in some “initial” period this would not produce the same classification as “developed”. For instance, in 1960 the data say Venezuela had higher income than France, Iraq than Japan, Mexico than Greece. I feel the OECD non-OECD distinction

captures the more general meaning of “developed” than do categories based strictly on income. This definition of developed does affect the results. One of the notable features of the data is the very strong performance over this period by the initially “poorer” members of the OECD: Ireland, Portugal, Italy, Japan.

There are two companions to this paper. One is a set of graphs of y , for each country, with all the growth statistics embedded into the graph. The graphs have common horizontal and vertical scaling (although not intercepts) so that variability and growth rates can be visually compared across countries (see representative figures below)³. A second is the country by country results for each statistic computed, available on the World Bank’s Growth Research Web site.

³ Although a necessary drawback of choosing a common scaling is that the high growth (mainly East Asian) countries go off the top of their graphs.

Table 1: Description of the calculated statistics on growth rates	
A) Basic statistics on level and average growth	
<i>Least squares growth rate</i>	the coefficient b from a trend line regression, $\ln(y_t) = a + bt + \varepsilon$
<i>Initial Income</i>	GDPPC for the first year (y_0), generally 1960.
<i>Final Income</i>	GDPPC for the final year (y_T), generally 1992.
<i>Average Annual Growth</i>	$(y_T / y_0)^{1/T} - 1$ average of the annual growth rates.
<i>Ratio of Final Income to</i>	$y_T / \max(y_t)$ or $y_T / \min(y_t)$
<i>Maximum (Minimum)</i>	
B) Statistics on Instability in Growth	
<i>Growth rates by period</i>	This calculates the least squares growth rates for the periods 1960-73, 1973-82, and 1982 to the most recent.
<i>Best Single Breakpoint in Trend</i>	if $\ln(y_t) = a_I + b_I t + a_{II} + b_{II} t + \varepsilon_t$ where period I is $\{1, \dots, t\}$ and period II is $\{t+1, \dots, T\}$ then t chosen to minimize the SSE (constrained so that $t > 6$ and $T-t > 6$). Four statistics are reported, <i>year of breakpoint</i> (t); <i>growth before the break</i> (b_I); <i>growth after the break</i> (b_{II}); <i>difference in growth rates</i> ($b_{II} - b_I$).
C) Statistics on Volatility in growth	
<i>(ln) First differences</i>	$fd_t = \ln(y_t) - \ln(y_{t-1})$, reported are the <i>Coefficient of Variation</i> , <i>Mean</i> , and <i>Standard Deviation</i> .
<i>ln second differences</i>	$sd_t = \ln(y_t) - \ln(y_{t-2})$ reported is the <i>median of the absolute value</i>
<i>Deviations from trend</i>	Where $e_t = a' + b' \ln(y_t)$ is the deviation from trend reported are the <i>Standard Deviation of e_t</i> , and the <i>R-squared of the trend regression</i> .
<i>Forecast Errors</i>	$fe_t(10,3) = \ln(y_t) - \ln(y_t)'$, the actual less the three year ago predicted value where the prediction is $\ln(y_t)' = \ln(y_{t-3}) + b' * 3$ where b' is estimated on data from $t-3, t-3-10$. Reported are the absolute value of the <i>Mean</i> and the <i>Maximum</i> .

II) Results

A) Basic Growth Statistics

Growth rates were substantially faster in the developed countries than LDCs. The median growth rate over the entire period for the developed countries was 2.86, almost twice the 1.51 rate for the developing countries. As many others have emphasized, incomes show absolute divergence, with a widening of the cross-national distribution of income (Quah, 1997). The ratio of median incomes of the two groups increased from 5 to 1 to over 7 to 1. The correlation between initial income and growth rates is *positive* .22.

Table 2: Summary Statistics on Basic Growth Rates								
	LSQ growth	Growth rates by period			Initial GDPPC	Final GDPPC	Final/ max	Final/ min
		60-73	73-82	82- recent				
Developing Countries								
Mean	1.64	2.68	1.74	0.10	1385	2639	0.82	2.04
Median	1.51	2.72	1.99	-0.13	1103	1869	0.88	1.61
Std. Dev.	1.98	2.20	3.22	2.94	1089	2696	0.18	1.37
Developed Countries								
Mean	2.90	4.26	2.05	2.47	5430	12665	0.98	2.69
Median	2.86	3.97	1.79	2.10	5553	13118	1.00	2.42
Std.Dev.	1.05	1.57	1.51	1.14	2368	3062	0.04	0.98

The gap in growth rates between developed and LDCs grew substantially in the most recent period. Growth rates for the developed and LDC groups were 3.9 versus 2.7 (a gap of 1.2 points) in the 1960s, then in the post-oil shock period the growth rates were slightly lower

for the developed, 1.79 versus 1.99 (a gap of -.2 in favor of LDCs). But since 1982 the growth rates have been 2.1 for the developed and *negative* (-.13) for the LDCs, a growth gap of 2.2 points ⁴. This confirms that the period since sometime in the 1980s has been very bad indeed for the LDCs, with the important exception of the two largest countries India and China⁵.

The divergence of per capita incomes has been more rapid in the last decade than either over the very long-run of history or over of the period from 1960-1982⁶. This must be true historically because the growth of the developed countries has been quite stable at around 2 percentage points while the *lowest* growth could have been over the very long-run is zero, so that the current growth gap of 2 percent in the developed and *negative* in the LDCs must be at least slightly larger. On the other hand, since many of the poor countries were very very poor around 1960 they must have experienced low growth rates historically. This implies developing country growth rates of 2 percentage points or more in the period after 1960 must have been an acceleration in growth relative to their historical long-run rate and hence divergence was probably less rapid for some part of the post WWII period until the recent

⁴ In the 1997 *World Development Report* table 1 shows the population weighted average GNP per capita growth for the decade 1985-95 for the "low income" countries (excluding India and China) was -1.4, for "lower middle income" countries growth was -1.3, for "upper middle income" countries .2, and for high income countries growth was 1.9.

⁵ This does mean that we are focusing on the growth experience of *countries* in the world rather than the growth experience of *individuals* in the world, in which the growth of India and China obviously looms large.

⁶ This is important in part because the early round of studies discussing convergence (conditional and otherwise) were based on the version of the Penn World Tables that gave data only through 1985. Some might read something ironic into the explosion of the academic economic literature on "convergence" (albeit "conditional") during exactly the period in which the world may well have been at its all time peak rate of divergence.

growth deceleration (discussed below) than it was in the 1870 to WWII period (Pritchett, 1997).

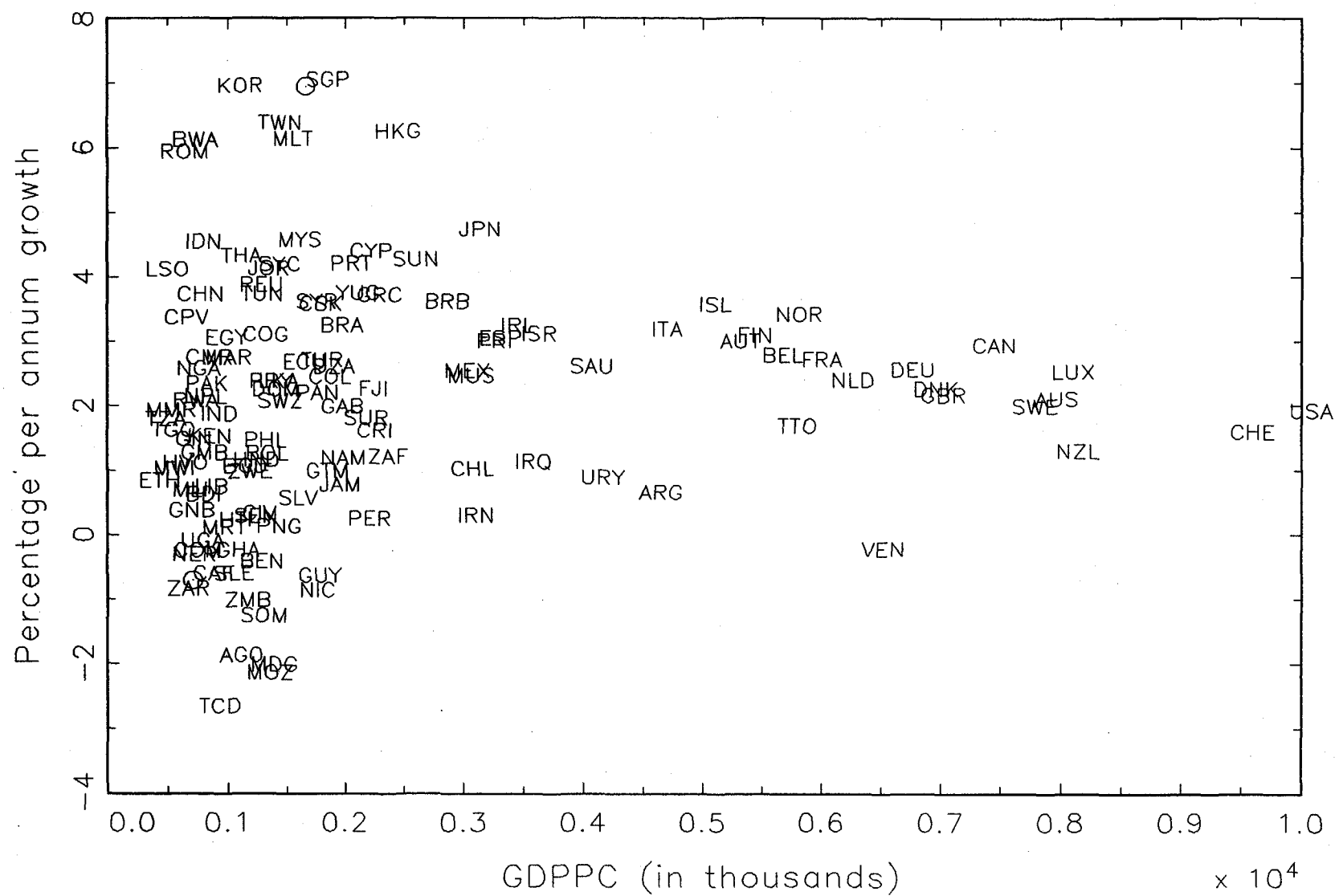
Table 2 also shows the *variance* in growth rates across countries is much larger amongst the LDCs than the developed countries. The standard deviation of growth rates is around 1 percent for the developed countries and nearly twice as large, around 2 percent, for the LDCs.

Figure 1 shows the scatter plot between initial income and subsequent growth rate. While the positive correlation between growth and initial income is barely visible, the enormously larger variance in growth rates of those countries that began the period below P\$3,000 is obvious and striking. This difference in the variability of growth rates between the two groups has also grown recently as the standard deviation of growth in the developed countries for the most recent period is 1.15 compared to nearly 3 for the LDCs. This reflects the contrasting experience of continued growth in the (especially East Asian) stars with a general, and at times precipitous, deceleration of growth in most other countries⁷.

The larger variance among developing countries is seen in the extremes of growth. The developed countries' growth rates fall into a narrow range. The fifth fastest, Greece, grew at 3.6 while the fifth slowest, Australia, grew at 2.0, a growth difference of 1.6 percentage points. In contrast the fifth fastest growing LDC, Botswana, grew at 6.0 percent while the fifth slowest, Somalia, *fell* at a pace of 1.36 percent, a growth difference of over *seven*

⁷ The slow and decelerating growth among many of the poorest countries (particularly in Africa) combined with the continued higher than world average growth rates and absolute convergence in levels amongst the "poorer" but still well-off European among the countries contributes to an emerging "twin peaks" in the distribution of world income (Quah, 1997).

Figure 1: Growth rates and initial per capita income



percentage points⁸. Growth differentials of this magnitude produce rapid shifts in relative incomes. Korea has gone from having *less* per capita income than Angola to having *ten times* more in just thirty years.

Table 3: Five highest and lowest growth rates, developed and developing				
	Developing		Developed	
Five Highest	Singapore	6.95	Malta	6.03
	Korea	6.85	Japan	4.63
	Taiwan	6.29	Cyprus	4.29
	Hong Kong	6.15	Portugal	4.10
	Botswana	6.03	Greece	3.61
Five Lowest	Somalia	-1.36	Australia	1.99
	Angola	-1.97	Sweden	1.88
	Madagascar	-2.12	USA	1.81
	Mozambique	-2.25	Switzerland	1.49
	Chad	-2.75	New Zealand	1.19

B) Growth instability

After an examination of trend rates of growth the next step is to notice that most countries' GDPPC is not at all well characterized by a single "trend" growth rate. Examination of the statistics, and especially of the graphs, reveals large shifts in growth rates. These shifts are localized in episodes of discrete shifts in growth rates. Ben-David and Papell (1997) introduced the analysis of growth *shifts* which I simply extend to all countries⁹.

⁸ Of course the absolute magnitude of the growth differential between the fastest and slowest is also larger because there are more LDCs than developed countries but this does not explain all of the gap.

⁹ The major difference between my approach and that of Ben-David (1997) is that he reports summary statistics of growth changes only for those which are statistically significant. I think this confounds two issues: of the growth shift and of the power of the test of the growth shift. This problem of statistical power is especially problematic given the information below about the differing volatility of the series. The higher volatility growth series will be less able to detect a shift. For two countries with equal magnitude shifts in growth rates but differing underlying volatility, one shift might be statistically significant and the other not.

The first noticeable aspect of growth shifts is the enormous deceleration of growth. The typical country has seen growth decelerate by 2 percentage points. For the developed countries this is largely two phenomena, a global deceleration following the oil shocks and the deceleration of the European countries from their rapid post-WWII catch-up of the 1950s and 1960s. In the LDCs, there are a larger variety of experiences, which we discuss below.

A second interesting feature is that the differences in growth rates within countries over time are large. The standard deviation of the shift is an enormous 3.85 percentage points and among the LDCs the average of the absolute value of the shift in growth rates is 3.4 percentage points. This is much larger than the cross sectional variance of 2.0 or the median growth rate for LDCs of 1.51. Fifty-five of the 125 countries had growth rates either decelerate or accelerate by more than 3 percentage points within the period. Figure 2 shows these shifts in growth, identifying those that decelerated or accelerated by more than two percentage points, as well as the stability at high rates of the East Asian stars.

Figure 2: Growth rates before and after break point

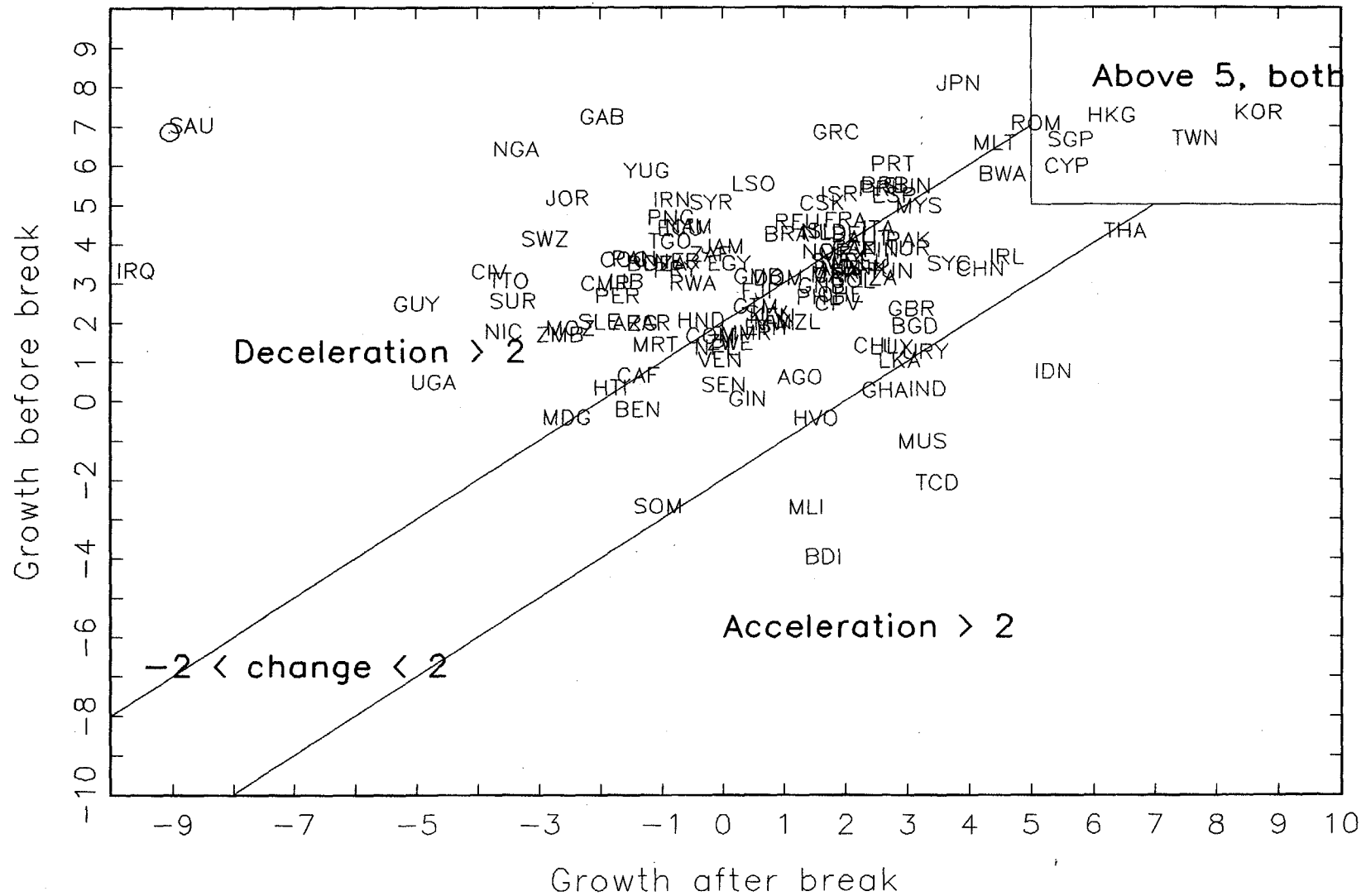
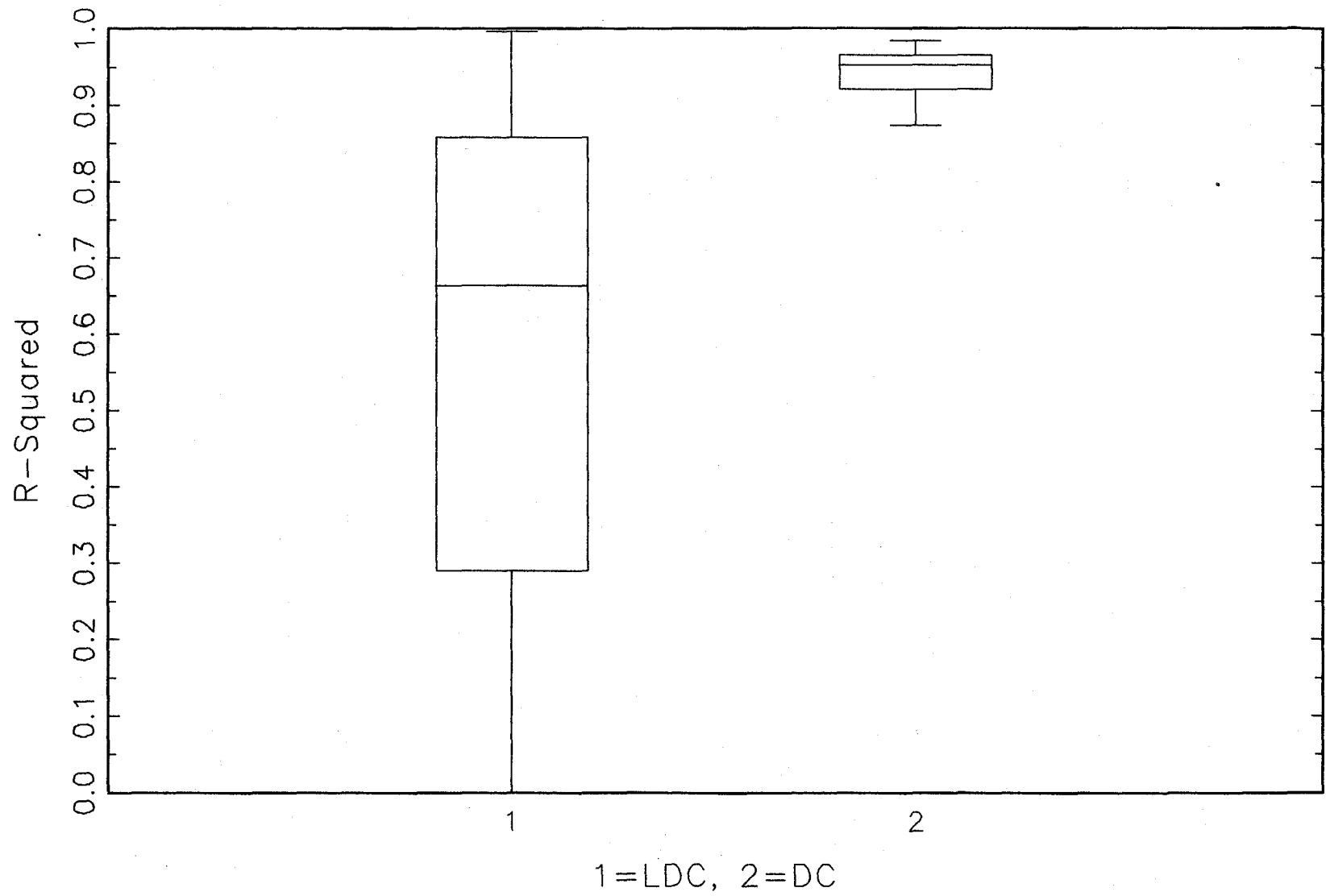


Table 4: Statistics on Instability of growth rates					
	Summary from “best break” analysis				R-Squared of trend
	Year	Pct. Point Shift	Growth Before	Growth After	
Developing countries					
Mean	1977	-2.58	2.62	0.05	.58
Median	1978	-2.21	2.86	-0.04	.67
Std. Dev.	4	3.53	2.23	2.99	.32
Developed					
Mean	1975	-1.91	4.07	2.17	.94
Median	1974	-1.93	3.83	1.84	.95
Std. Dev.	4	1.46	1.53	1.04	.03

These large shifts in growth rates imply GDPPC is not, in general, well characterized by a *single* exponential trend. The final column of table 4 shows the R-squared of fitting a single time trend through y or how much of the time series behavior of y is “just the trend.” This statistic perhaps best captures the striking differences in the behavior of output in the developed and developing countries. In the developed countries the median is .95 and the standard deviation only .03. For nearly every developed country the *total* time series variance of y is summarized in a single number: the average growth rate (figure 3). While there obviously OECD countries have business cycle fluctuations and shifts in growth, these are not the dominant features of the evolution of y .

In contrast, for the developing countries “growth” is not just the trend. The median trend R-squared is only .67 and the standard deviation is .32. For forty percent of the LDCs the trend R-squared is less than .5. The box-plots in figure 3 show the maximum and minimum of

Figure 3: Boxplot of the R-Squared of a single trend, LDCs and DCs



the two groups, with the top and bottom of the boxes showing the 75th and 25th percentiles and a line at the median. The strikingly different behavior of the two groups is well illustrated as while the developed countries are very narrowly grouped between .9 and 1, amongst the LDCs the trend R-squared values are distributed almost evenly from 0 to 1. The interpretation of low R-squareds is complicated, as it involves both the magnitude and the deviations from the trend and leads to an analysis of the patterns of growth.

Patterns of growth Examination of the statistics on the levels and shifts in growth rates and of the individual graphs reveals six distinct patterns of growth, based on the speed of growth before and after the statistically identified structural break in growth. Table 5 places each country into one of these patterns.

* “Steep hills”: These 11 countries had steady and rapid growth (above 3 percent in both periods). This set is the high performing East Asian countries, a few European periphery economies (Cyprus, Ireland, Malta) and besides that, just Botswana. In these countries the trend is high and stable and hence is everything, like Thailand (.99) (figure 4). (In the figure for Thailand all of the growth statistics reported on the graph are labeled as a guide to the rest of the country figures given in the text (the others are available on request)).

* “Hills”: These 27 countries had growth above 1.5 percent in each period¹⁰. Like the USA (figure 5) most of the OECD countries are in this category (14 of 23). A few

¹⁰ Actually the exact number used is 1.48 percent (rounded up to 1.5 interest because 1.48 sounds silly). In any case the cut-off points are somewhat arbitrary and are rigged according to the outcomes that corresponded to my intuitive feel, particularly to retain the USA as a “Hill” not a “Plateau.”

steady growers in the developing world (Costa Rica, Pakistan) also are in this category. For these countries trend R-Squared is also typically high (.91 for Pakistan) (figure 6).

* “Plateaus”: These 16 countries had growth above 1.5 percent before their structural break and growth less than 1.5 but greater than zero, thereafter. These countries are a mixed bag. The classic case is Brazil with growth of 4 percent until 1980 and .66 percent afterwards (figure 7). Other countries are less true plateaus and more borderline hills, like Sweden with growth of 3.36 percent before and 1.4 percent after.

* “Mountains”: These 33 countries had growth above 1.5 percent before their trend break, but negative growth rates afterwards. This category includes most of the oil exporting countries (Nigeria (figure 8), Gabon, Algeria, Saudi Arabia), a number of commodity exporters that experienced positive, then negative price shocks (Jamaica, Guyana, Côte d’Ivoire (figure 9), Zambia), many Latin American countries affected by the debt crisis (Argentina (figure 10), Bolivia, Paraguay). The “mountains” include some countries with “cliffs” with sharp drops over a couple of years usually cases of war and/or civil unrest (Liberia, Mozambique, Nicaragua (figure 11)). The “mountain” countries had a sharp break in their growth experience and hence often a low trend R-Squared (e.g., Côte d’Ivoire .013, Argentina, .204, Nicaragua .190). For instance Jamaica’s growth for the whole period is .8 percent, but was 3.76 percent before 1976 and -.36 percent after and the overall trend R-Squared is only .18 (figure 12).

* “Plains”: These 17 countries had growth below 1.5 percent both before or after their structural break. Nearly all of these countries (14 of 17) are in Sub-Saharan Africa. Senegal is a classic pure “plain” with continuous stagnation and a reasonably steady

growth rate around zero (.18) hence y is reasonably characterized by a trend growth but with low R-squareds (.213) (figure 13). Included within “plains” are countries with consistently negative growth rates, such as Mozambique, who might be well be characterized as “valleys”.

* “Denver”¹¹: These 7 countries did not have growth above 1.5 percent before their structural break, but did afterwards. This class includes a number of clear success case

¹¹ The only geographic metaphor I would think of was Denver where the Great Plains meet the Rocky Mountain.

accelerators like Indonesia (figure 14) and Mauritius (figure 15), some less clear cut cases. At times the “acceleration” was from low or negative levels to respectable, but

Table 5: Classification of countries by growth rate level and change							
Class	Total	Developed	Developing				
			East Asia	South Asia	MENA	LAC	SSA
Steep Hills ($g_b > 3$, $g_a > 3$)	11	CYP, IRL, JPN, MLT (4)	HKG, KOR, MYS, SGP, THA, TWN (CHN) (6)				BWA (1)
Hills ($g_b > 1.5$, $g_a > 1.5$)	27	AUS, AUT, BEL, CAN, CHE, DEU, DNK, ESP, FIN, FRA, GRC, ITA, PRT, USA (14)	CHN, MMR, PHL (3)	BGD, PAK (2)	ISR, TUN, TUR (3)	BRB, COL, CRI, MEX (4)	TZA (1)
Plateaus ($g_b > 1.5$, $0 < g_a < 1.5$)	16	NLD, ISL, NZL, SWE (4)			MAR (1)	BRA, DOM, GTM, SLV (4)	ETH, GMB, GNB, KEN, LSO, MWI, SWZ (7)
Mountains ($g_b > 1.5$, $g_a < 0$)	33	GBR (1)	NAM, PNG (2)		DZA, EGY, IRN, IRQ, JOR, SAU, SYR (7)	ARG, BOL, ECU, GUY, HND, JAM, NIC, PAN, PER, PRY, SUR, TTO (12)	CIV, CMR, COG, GAB, LIB, MOZ, NER, NGA, SLE, TGO, ZAF, ZAR, ZMB (13)
Plains $g_b < 1.5$, $g_a < 1.5$)	17			NPL (1)		HTI, VEN (2)	AGO, BDI, BEN, CAF, GIN, HVO, MDG, MLI, MRT, RWA, SEN, SOM, UGA, ZWE (14)
Accelerators $g_b < 1.5$, $g_a > 1.5$)	7		IDN (1)	IND, LKA (2)		CHL, URY (2)	GHA, MUS (2)
Number:	111	23	12	5	11	24	36

The simple procedure and its classification scheme do capture some of the well know stylized facts about differences in growth across regions. The OECD is nearly all in the hills or steady hills groups (18 of 23) with the exceptions mostly borderline. Nearly all of the

“plains” are countries in SSA (14 of 17) but not all SSA are “plains” (14 of 36) a nearly equal amount are mountains (13 of 36). This is in contrast with two other regions with slow overall growth, Latin America with very few “plains” (2 of 24) but many “mountains” (12 of 24) and MENA, with 7 of 11 mountains.

The classification does throw up some anomalies, which reveal some limitations of the method. For instance, China is a consistent growth performer because the data only allow one break and so the disasters of the Great Leap Forward are smoothed over. Similarly, the data breaks Tanzania’s growth at 1980 and gives two reasonably high growth sub-periods, smoothing over the disastrous period from 1978 to 1984. Great Britain is a “mountain” because the data break its very smooth series at the peak of a cycle in 1987.

One implication of the fact of large changes in growth rates is that there is relatively little correlation in growth rates across periods. Easterly, Kremer, Pritchett, and Summers (1993) was devoted entirely to this point. Although casual discussions of “high performing” and “low performing” countries makes it seem as if relatively time-persistent characteristics accounted for the bulk of cross-national growth variation, the correlation over time periods across countries is actually quite low. The cross-national (rank) correlation of countries’ growth “before” and “after” their structural break is only .24. The low correlation is also seen in the shifts over time: between 60-73 and 73-82 is the correlation is .24, and between 73-82 and 82-most recent only .32.

Figure 4: Evolution of (ln) GDP per person for THA

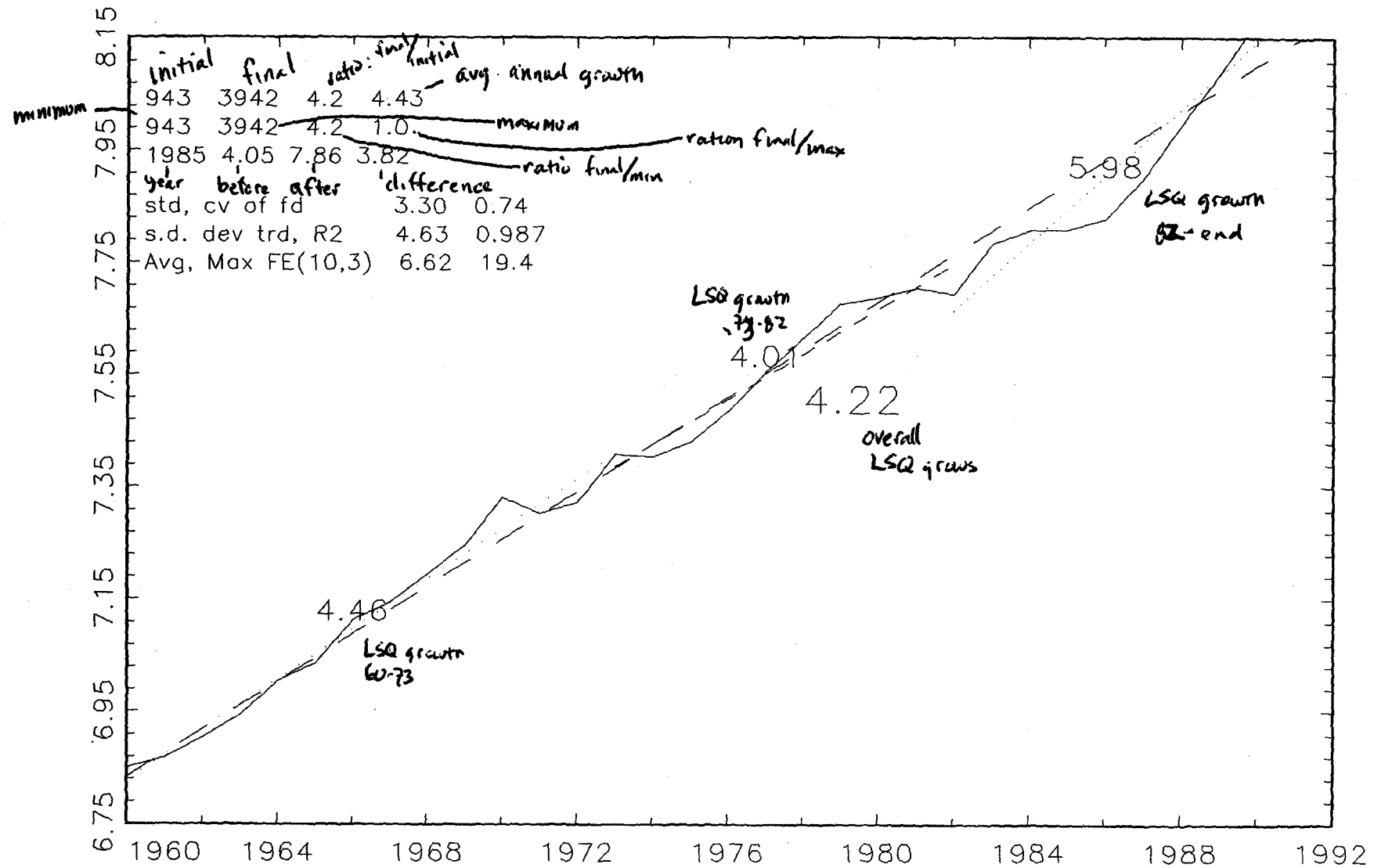


Figure 5: Evolution of (ln) GDP per person for USA

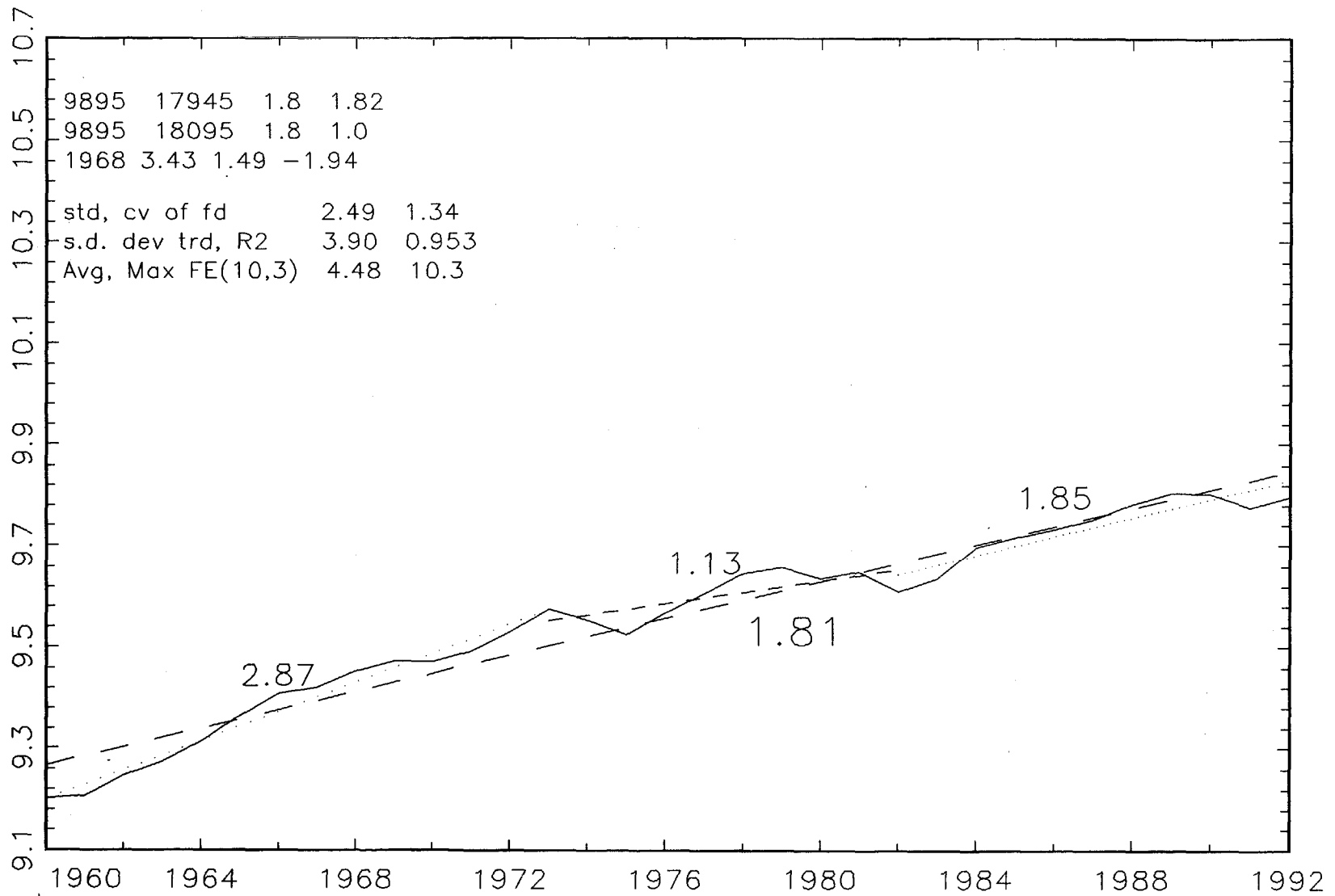


Figure 6: Evolution of (ln) GDP per person for PAK

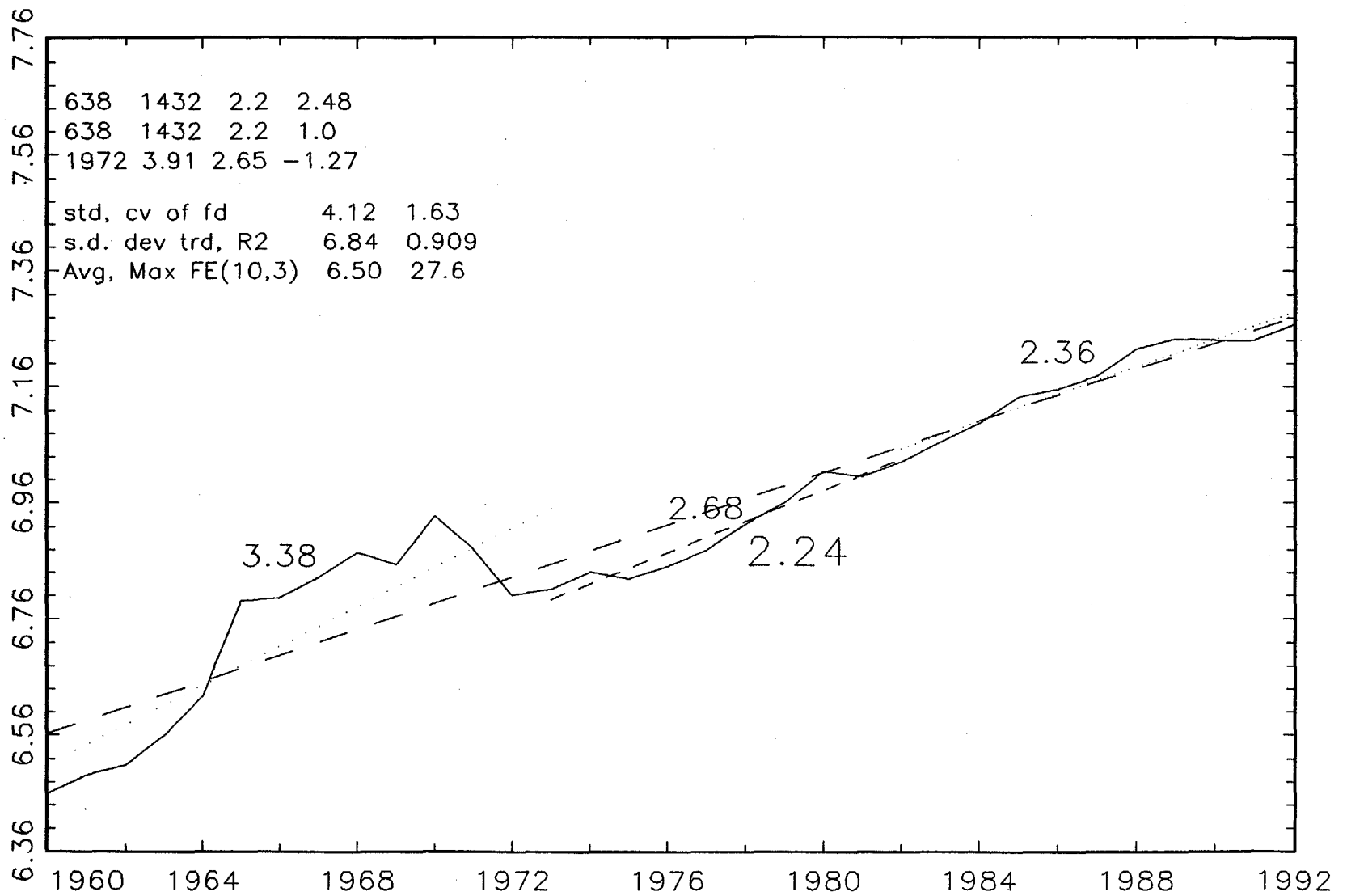


Figure 7: Evolution of (ln) GDP per person for BRA

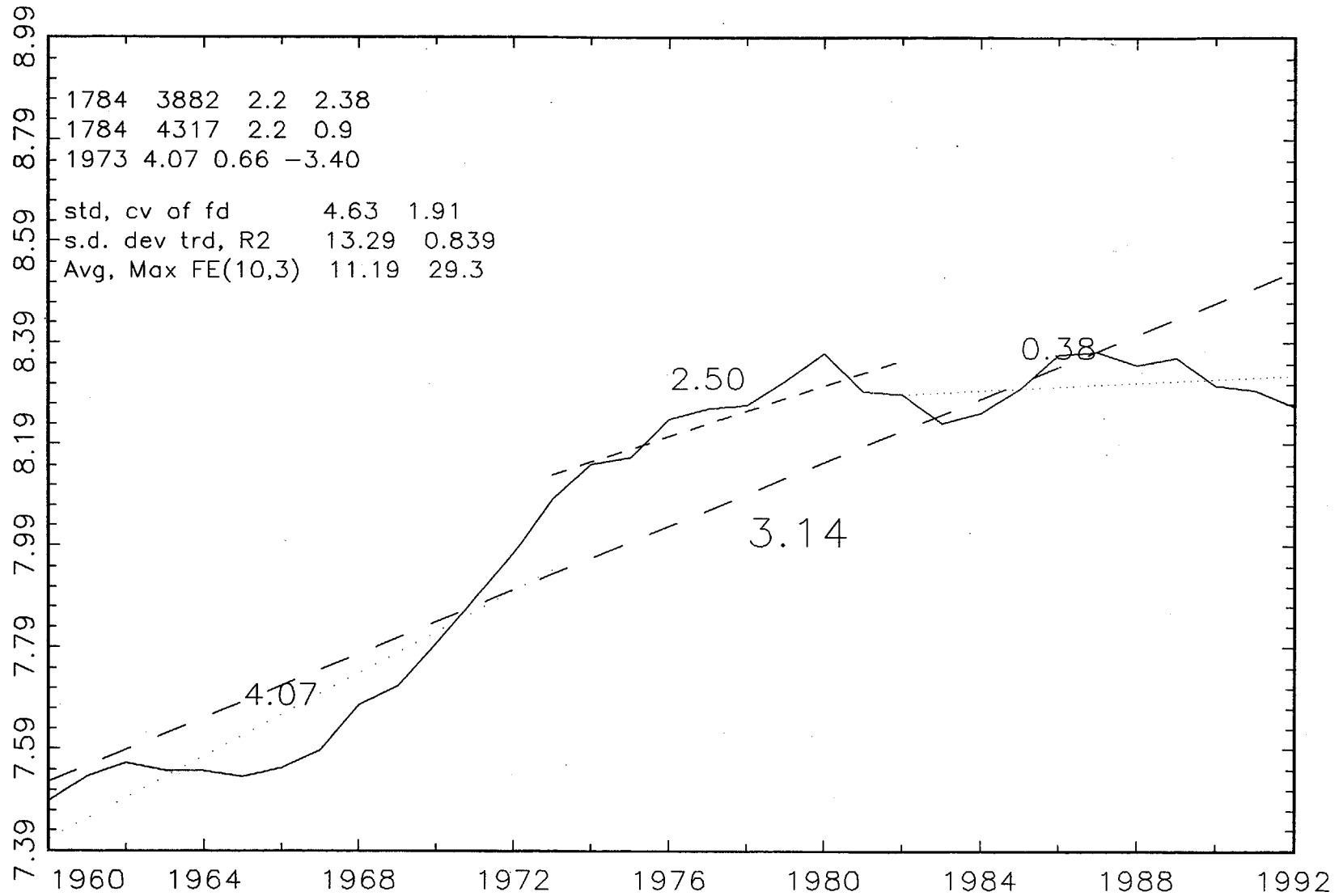


Figure 8: Evolution of (ln) GDP per person for NGA

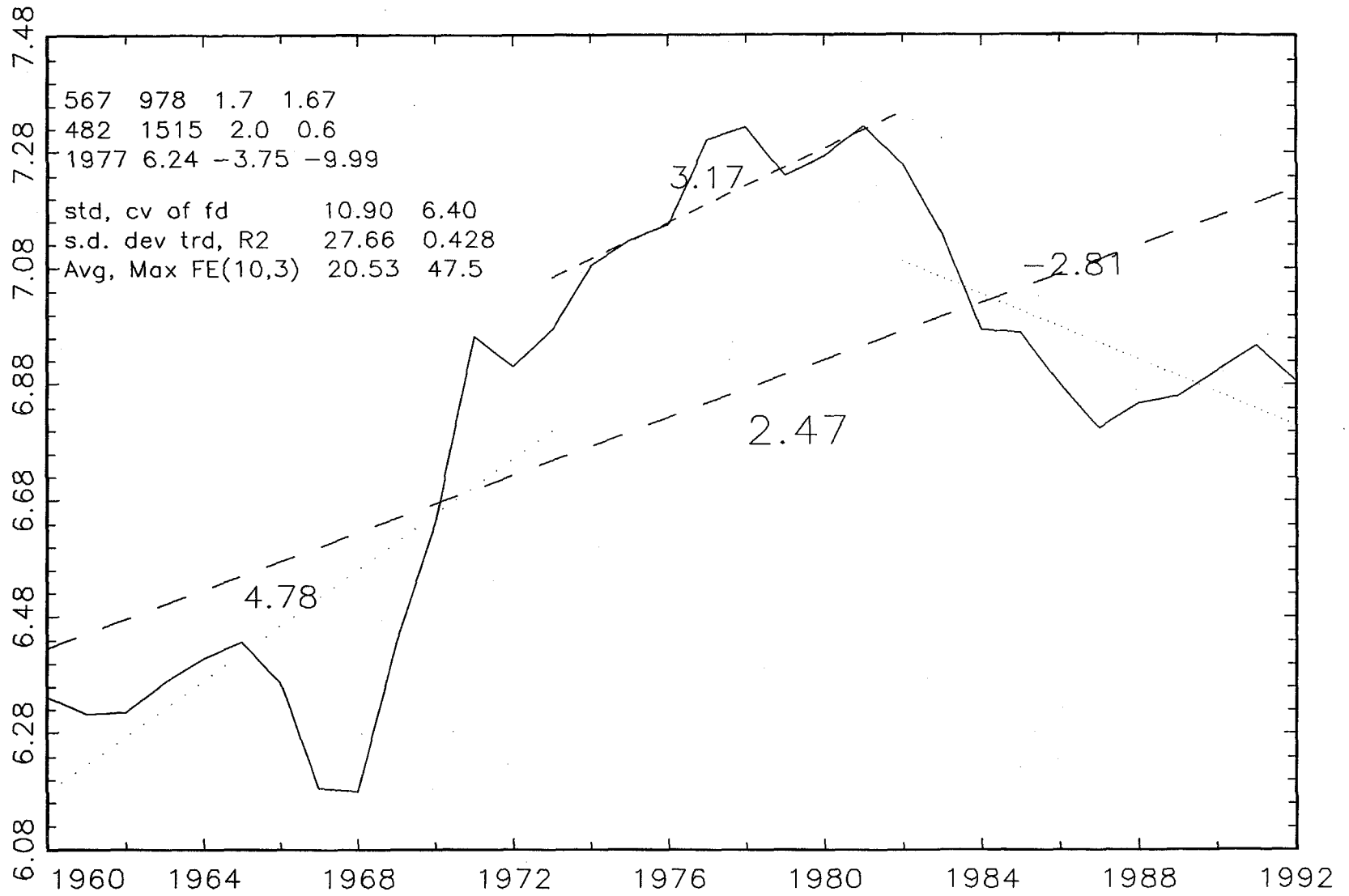


Figure 9: Evolution of (ln) GDP per person for CIV

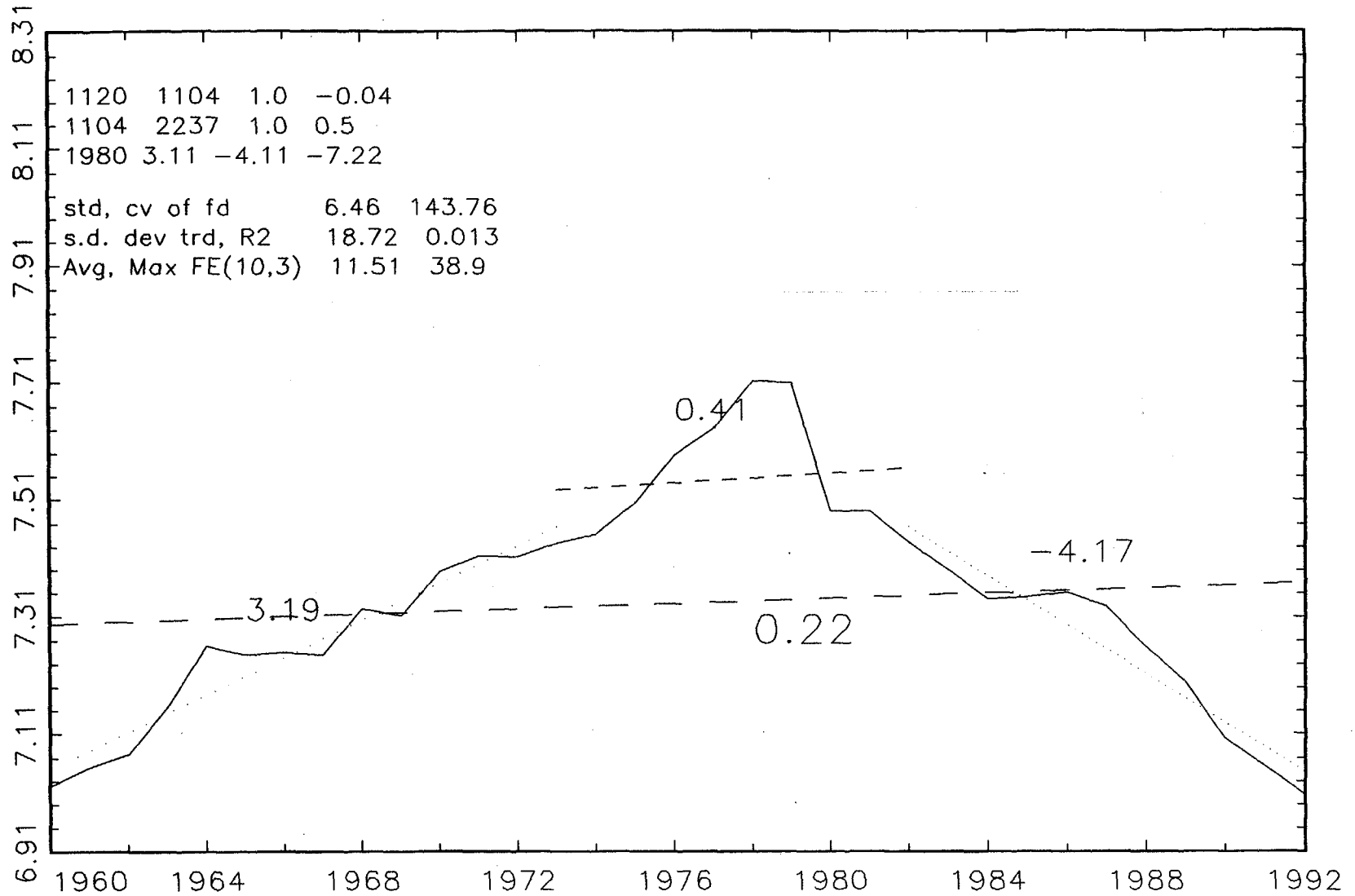


Figure 10: Evolution of (ln) GDP per person for ARG

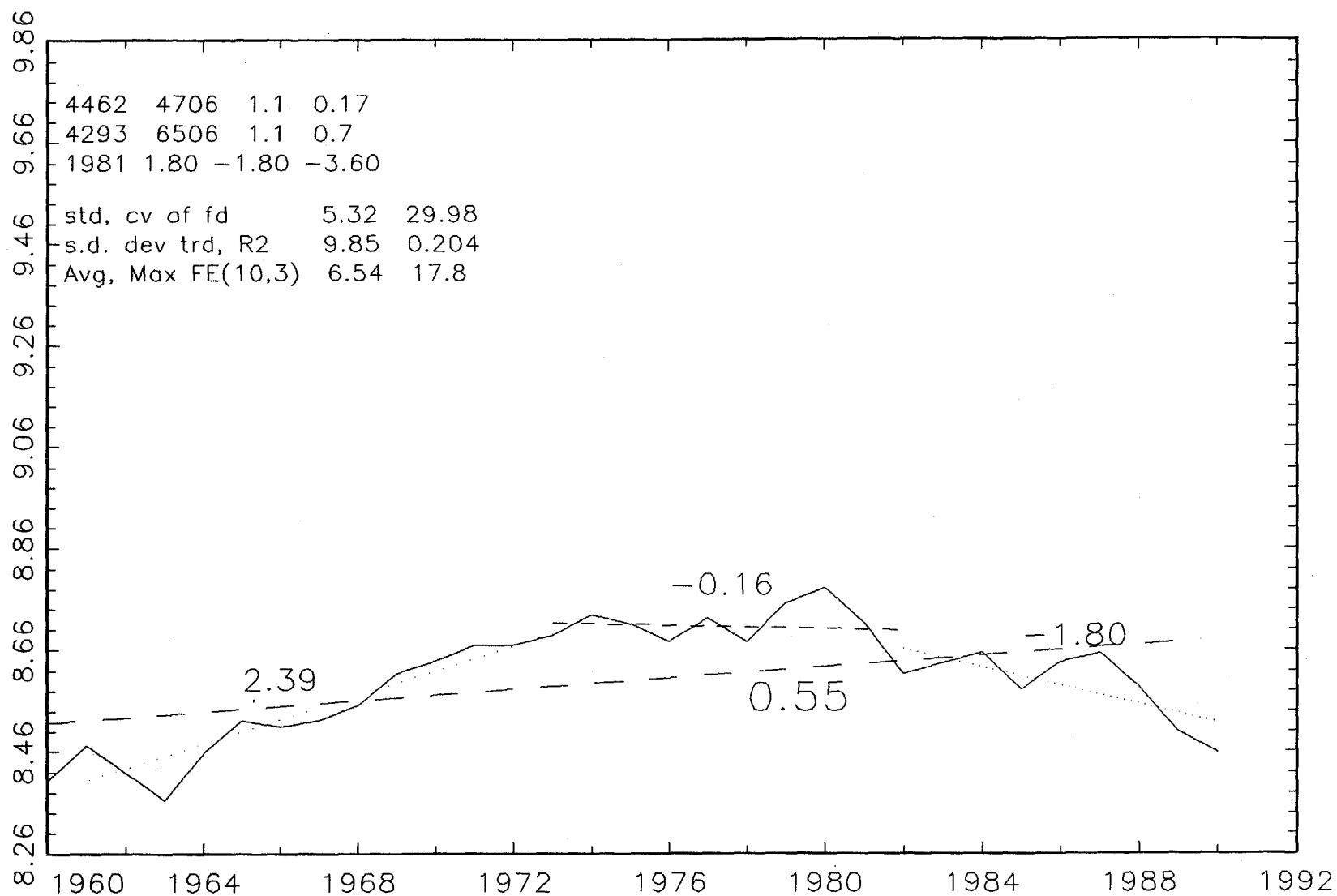


Figure 11: Evolution of (ln) GDP per person for NIC

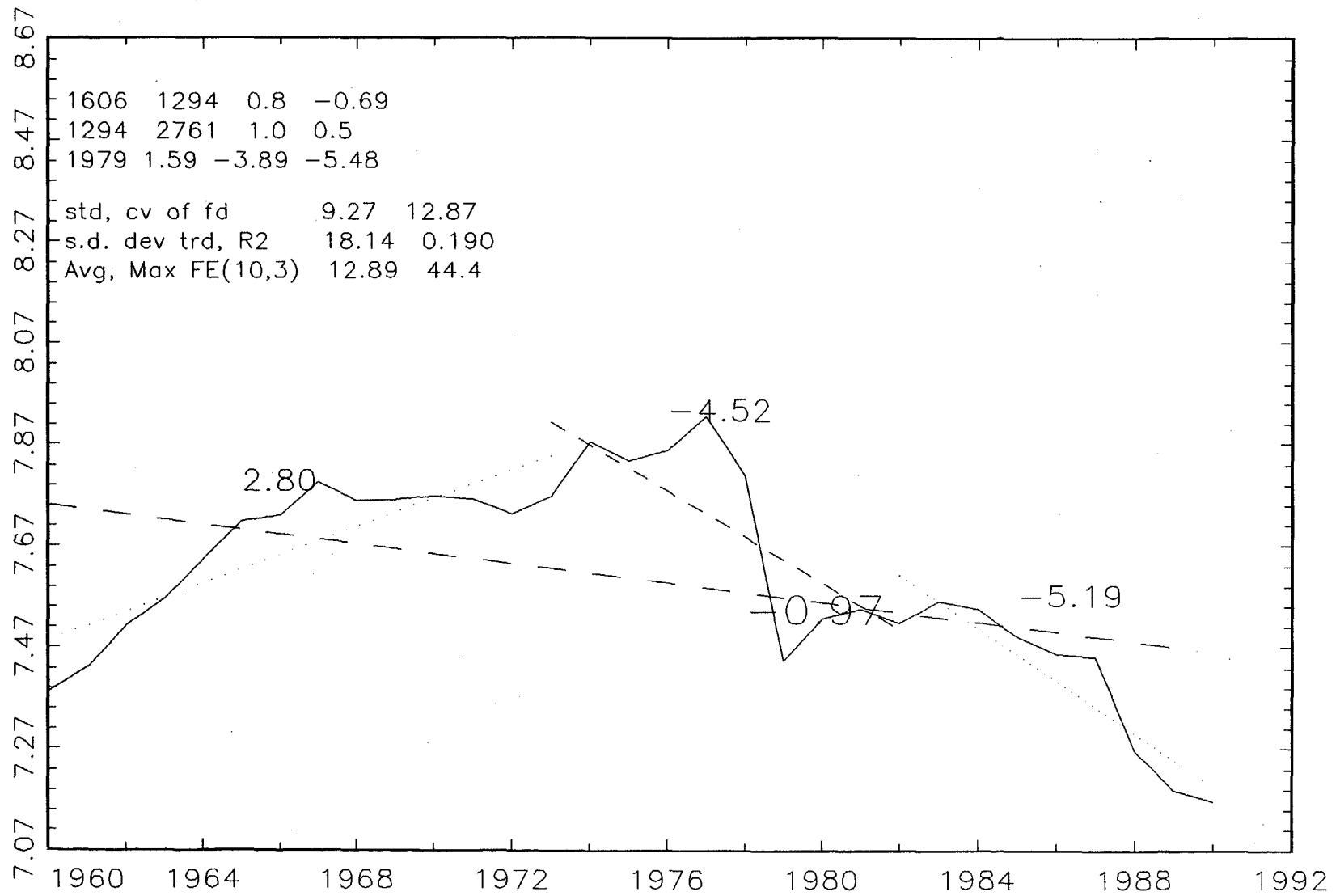


Figure 12: Evolution of (ln) GDP per person for JAM

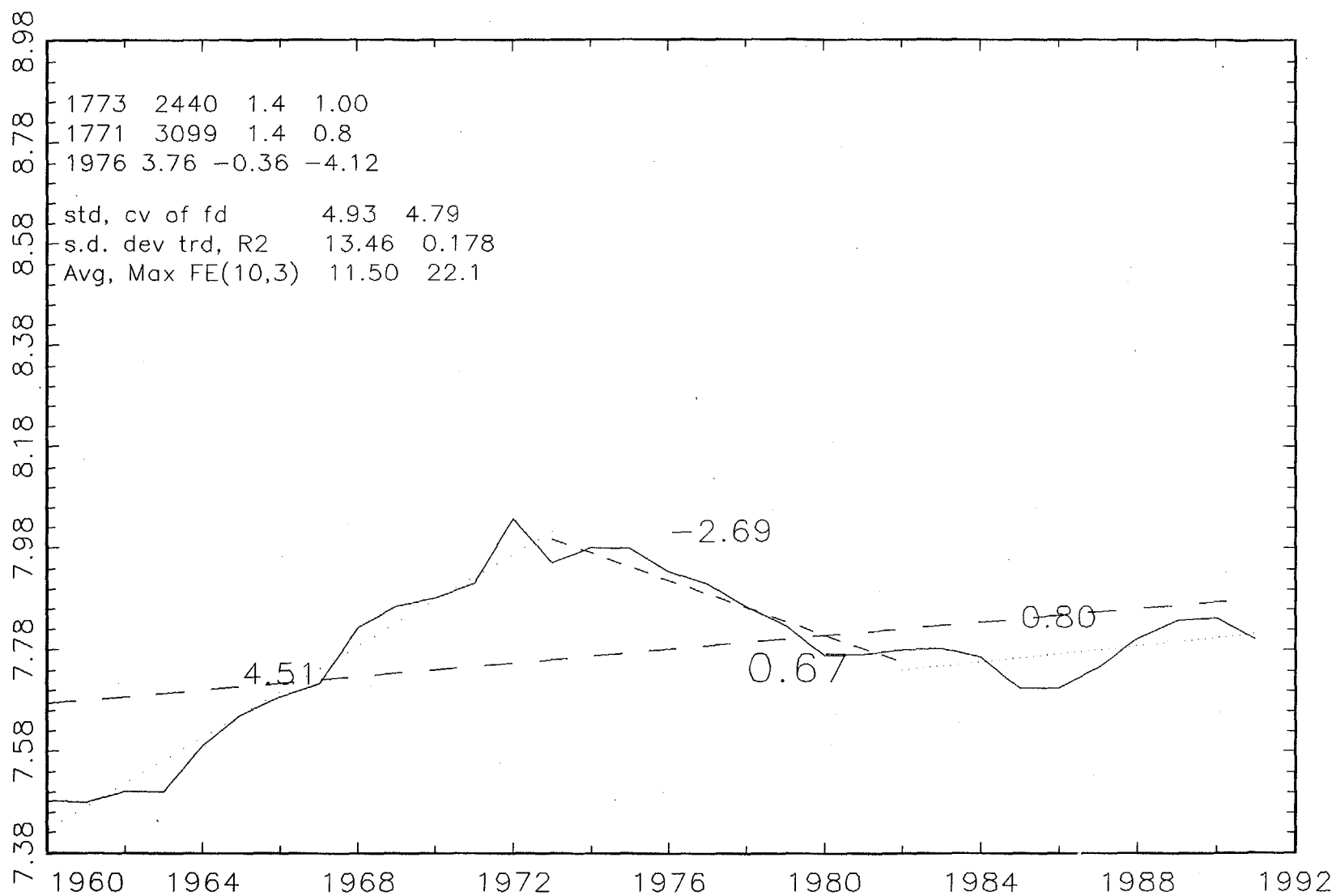


Figure 13: Evolution of (ln) GDP per person for SEN

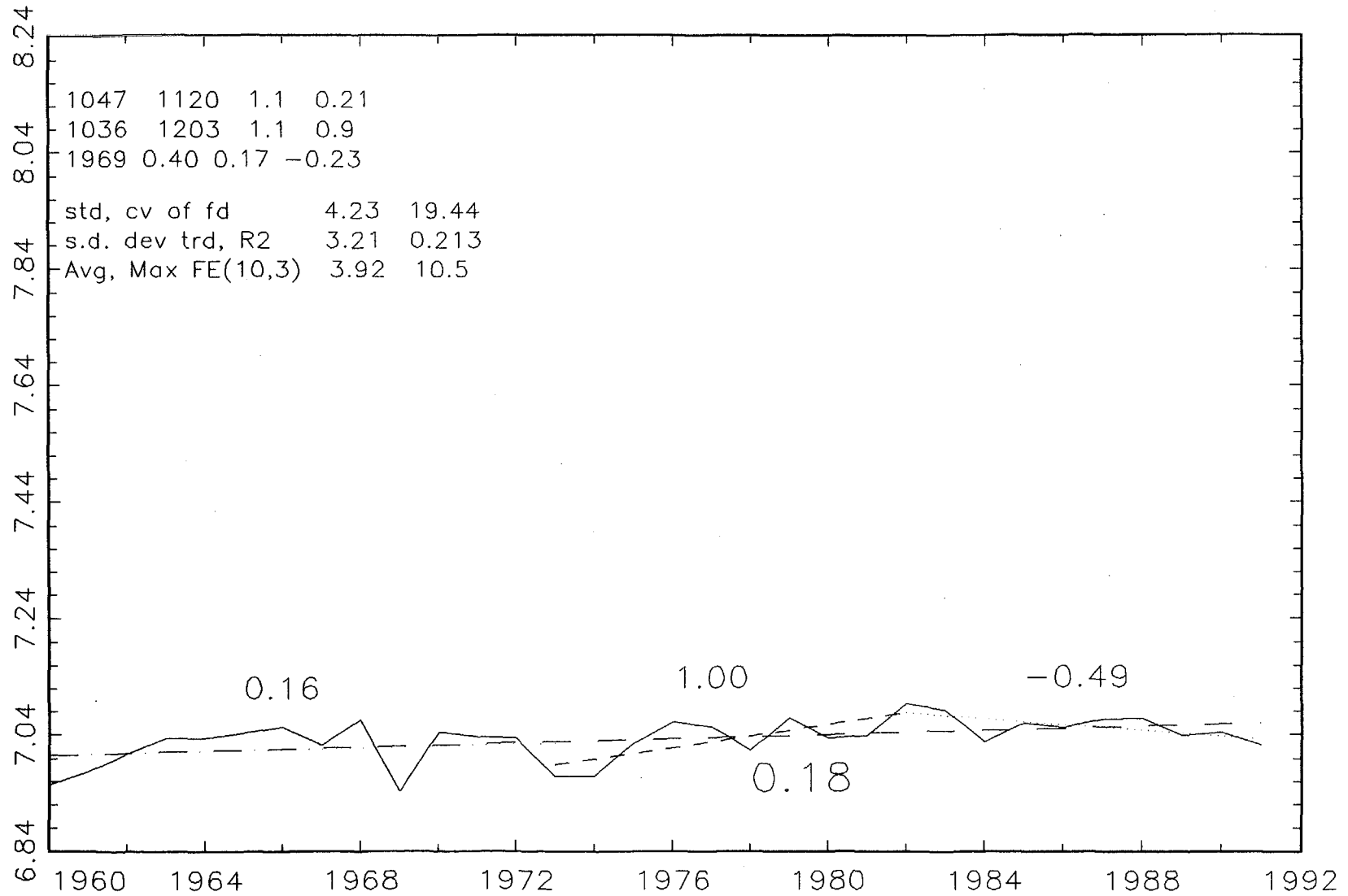


Figure 14: Evolution of (ln) GDP per person for IDN

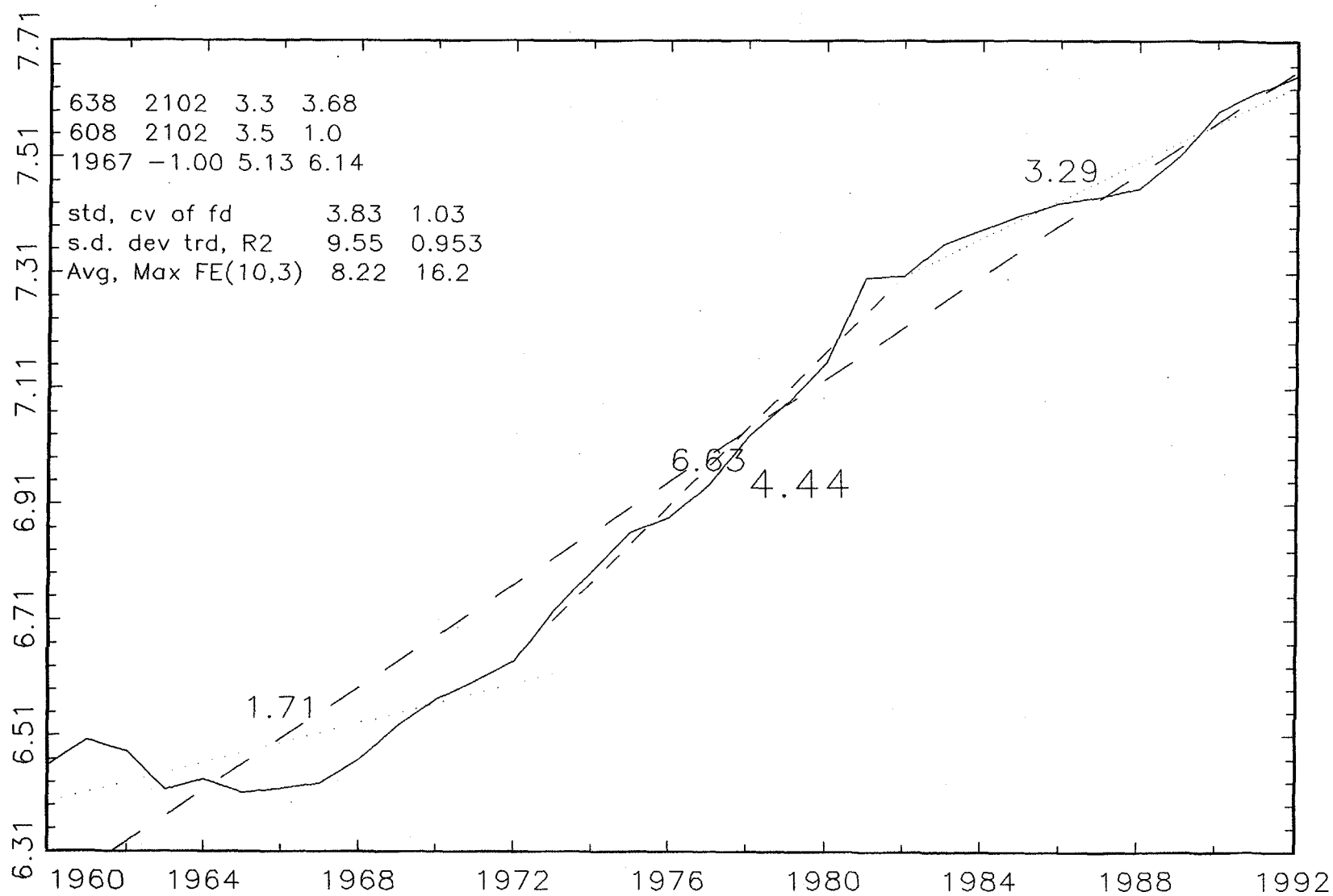
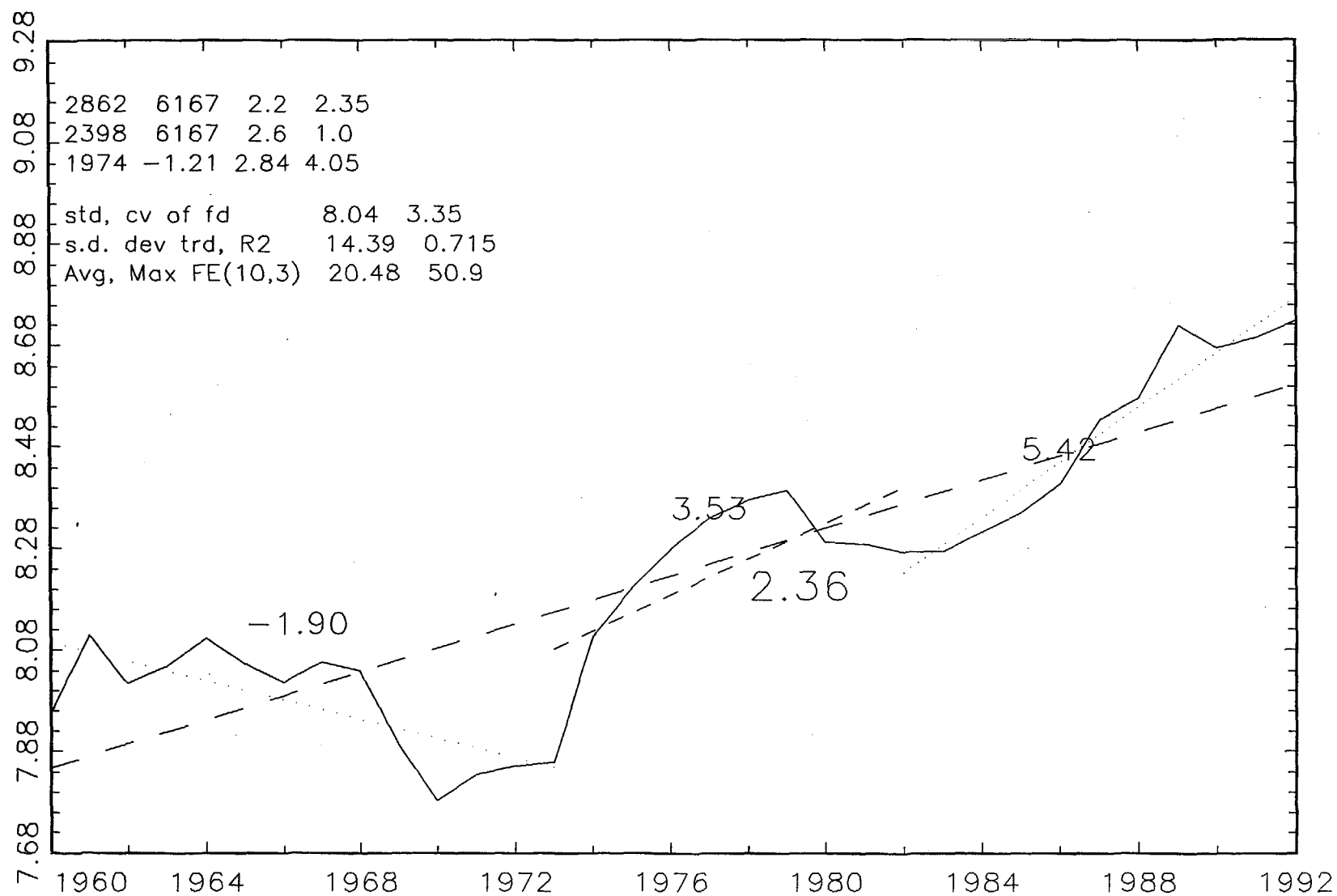


Figure 15: Evolution of (ln) GDP per person for MUS



C) Growth volatility

If a time series can be well represented by a single stable growth rate then measuring the volatility around that trend is relatively straightforward¹². However, since, the previous section has shown that nearly every country exhibits a large trend shift, simple measures based on the residuals from a trend will not give a good indication of the pure *volatility* of output. For instance, one country might have large volatility around a stable trend while another has very stable output in each of two sub-periods, but around two different trends, nevertheless the two countries would appear to have similar “volatility”.

Because of this difficulty in measuring volatility with shifting trends, I use three approaches. First, the standard approach combining instability and volatility: the standard deviation of the time series deviations of output from a single trend. Second, I calculate the coefficient of variation and standard deviation of the first differences of y . Also, to capture the possibility of stability around a trend with a single or few shifts, I calculate the median of the absolute value of the second differences¹³. Third, in the spirit of an intuitive notion of series “forecastability” I calculate how well three year ahead y is forecast based on a trend calculated off the previous ten years (so that history gradually erases the effect of past trend shifts). The average and the maximum of this forecast error are reported.

¹² I use the simple trend and deviations throughout instead of treating the series as difference stationary. I suspect that similar findings about the differences in volatility and shifts in the drift parameter between different countries would be found with that approach as well.

¹³ Suppose a country grew at g_1 in period 1 and g_2 in period 2, $g_1 \gg g_2$ but was perfectly stable within each period. Then the standard deviation of first differences would still be high but second differences (changes in the growth rate would be zero except one period).

However measured, volatility is much higher in the LDCs¹⁴. Table 6 shows that the median standard deviation of the deviation from trend is twice as high in LDCs as in the developed countries (.10 versus .05). The median forecast errors are also twice as large in LDCs (.094 vs .054) and the typical “worst” forecast error is also twice as large (.28 versus .14). The coefficient of variation of the (natural) log first differences of GDPPC is four times as high in a typical (median) LDC as in a developed country (4.3 vs 1.0)¹⁵. This is both because the standard deviation of the ln first differences is higher (.06) while the average LFD is (.03) is lower. Figure 16 shows the scatter plot of one measure of volatility, the standard deviation of the deviations from a single trend rate of growth, and initial per capita income.

¹⁴ The correlations amongst the various measures of volatility are high, but not so high as to suggest there are not real differences in some cases as to what aspect of growth variation they are capturing, but in ways I have yet to understand.

¹⁵ The *average* CV is 10 times as high because in several countries growth is near very zero and hence is probably a misleading as a summary statistic of central tendency.

Table 6: Summary statistics on the volatility of growth							
	Std. Dev. of Dev. from Single Trend	First Differences			Median abs. Value second differences (*100)	Forecast Error (3,10)	
		C.V.	Std.Dev.	Mean		Mean	Maximum
Developing countries							
Mean	0.112	10.597	0.065	0.018	0.7	0.114	0.314
Median	0.1	4.314	0.059	0.014	0.5	0.095	0.283
Std. Dev.	0.052	19.449	0.027	0.015	0.7	0.053	0.166
Developed countries							
Mean	0.063	1.14	0.031	0.029	0.4	0.056	0.153
Median	0.054	1.038	0.027	0.028	0.3	0.054	0.135
Std. Dev	0.026	0.473	0.013	0.011	0.4	0.022	0.086

III) *So you want to run a growth regression?*

In the second half I move away from the description and summary statistics about the time series of per capita growth and into some empirically based, but speculative, discussion of empirical research into the determinants of economic growth. Let me lay my cards on the table. I think there is a move afoot to expand the empirical growth regression research by “exploiting the panel nature of the data” at least partially based on a naive notion of “using all the data” so as to “not throw away information.” I argue this move to panel regressions is unlikely to add any useful knowledge about long-run growth. The instability and volatility of output imply the move to shorter and shorter time periods is likely to lead to a tangle of confusions about dynamics, specification, endogeneity and statistical power that will ultimately confuse, not clarify, the issues of growth, and especially development.

Some set-up of necessary. A theory of economic growth relates the level of income at each point in time (and hence its growth rate) to some other set of variables. There are three time dimensions of “growth” traditionally distinguished based on the notion of the equilibrium level of income as a function of underlying X variables denoted, $y^*(X)$, and the actual level of output, y . There are “steady state” differences in growth, different growth rates of $y^*(\cdot)$. There are “transitional dynamics” which themselves can be of two types. That is even if the growth of $y^*(\cdot)$ is unchanged, if the *level* of $y^*(\cdot)$ changes then there will be “growth” differences as y adapts to its new steady state level. In this sense any economic reform or once off shock has “growth” consequences. Moreover as the equilibrium growth path of y^* changes there will be dynamics of the actual evolution of y as it reaches the new growth path. Finally there are “business cycle” changes such that even in the absence of shifts in the equilibrium value of y^* there can be dynamics in y .

There are several problems that arise from mixing the quite different time scales of these three types of “growth” in growth regressions. The modeling behind “growth” regressions mostly claims to be about long-run equilibrium growth (or levels) and yet there is mostly very little discussion of either business cycles or of the dynamics of adjustments to either level or growth rate changes in the “theories” of growth regressions.

There has been a remarkable proliferation of variables included in growth regressions with literally hundreds of variables proposed, Xavier Sala-I-Martin (1997) alone has claimed to have run over two million growth regressions. This means some classification is necessary to talk about regressions. For the present discussion I classify the myriad of right hand side “ X ” variables by three features: exogeneity persistence and whether it is or is not a factor of

production. Persistence ranges from country specific time-invariant variables (e.g. latitude, access to the sea) to quantities that evolve very slowly (e.g. population size, human capital stock) to volatile series (e.g. black market premia, capital inflows, terms of trade). The typical “X” variables in growth regressions can be further classified into two types: “production function and “reduced form”. The production function variables are reasonably straightforward and the main differences arise in the time series specification (levels or changes of income on flows or stocks, and measurement (particularly of human capital). The “reduced form” regression covers a huge variety from whether countries have a coast (Sachs and Gallup, 1998) to whether citizens return a lost wallet (Knack and Keefer, 1997).

Table 7: My “gut feeling” classification of variables included in growth regressions			
Endogeneity:	Persistence:		
	High	Medium	Volatile
Low	“structural”: geographic (land locked, distance from the equator), climatic (rainfall), resource endowment (minerals) “institutional”: (e.g. ethnic diversity, political system, language, colonial experience, type of legal system).	investments, capital stocks	“Shocks”: terms of trade, spillovers from financial crisis, weather.
Medium		“policy”: quantities over which some individual or entity has more or less direct control (e.g. tariff rates).	
High		“intermediate outcome”: (e.g. trade ratio, inflation, budget deficit, financial depth).	“intermediate outcome” (e.g., FDI, export growth, budget deficit, black market premium).

With this classification of three meanings of “growth” and the classification of variables by persistence and exogeneity of the properties of the various variables included in “growth” regressions in place argue that, given the time series properties of the various variables, a move to the use of shorter panels is more likely to hurt than help studies of long-run growth. Consider two types of variables: high persistence, low volatility and endogeneity and those with high volatility and hence low persistence, but which are potentially endogenous.

High Persistence, low volatility variables. With variables whose values change only very slowly over time, such as whether or not a country is landlocked, or population size, or political or institutional characteristics, or the stock of education of the labor force, or

inequality, or etc. a move to shorter panels, particularly with the use of fixed effects is almost certain not to help, for three reasons.

First, the lack of identification of time-invariant effects using fixed effects in panel data is merely the limiting case of the decreasing statistical power as the “between” variance is discarded. With high persistence variables the fixed effect sweeps out most of the variation in the variable. For instance, using a panel of data at five year intervals, take the fraction of the total variation that is “explained” by country fixed effects as a measure of a variable’s “persistence.” Table 8 compares this for several variables that have been used in growth regression. Whereas at five year intervals the fraction of variance that is within countries is .73 for growth, it is much less, only .22 for investment ratios, only .07 for the level of education and only .02 for the size of populations. Other growth “determinants” have similar very strong persistence, like measures of democracy and civil liberties, and income inequality. In the recent Squire and Deininger (1997) data set over 90 percent of the total variation is cross-national.

This means that using fixed effects will “sweep out” large amounts of the variation of many of the interesting r.h.s. variables, while maintaining the volatile component of economic growth on the l.h.s. In column 4 of table 8 I report the how much lower the t-statistics would be using a Monte Carlo evaluation of a simple bivariate regression with 100 “countries” and 6 “periods” to mimic using five year panels with the existing data sets. Basically, the power of the t-tests would fall proportionate to the square of the ratio of the fraction explained by fixed effects. For a variable with the persistence of investment rates using fixed effects would cut t-statistics in half. With variable with the persistence of the level of education a five year

fixed effects in the panel would cut t-statistics to a third of their level in the cross section, implying that in the cross section the t-statistic would have to have been 6 to not be below 2 with the lower power of fixed effects. For quite stable variables, like population size, where nearly all the variation is cross national the t-statistics would be a fifth as large, so that it is essentially impossible to precisely identify the impact of these variables using fixed effect techniques.

Table 8: Differences in persistence between economic growth and typical “explanatory” variables in growth regressions and the implications for statistical power

Variable:	Number of countries, number of observations	Ratio Within Country to Total Variance	Ratio of t-statistics from fixed effects versus cross section regressions for a r.h.s variable with the within to total variance indicated (based on Monte Carlo)
Growth of GDP per capita	126/756	.73	
Population Growth	126/756	.31	.62
Investment Rates	126/756	.22	.54
Level of Education	84/504	.07	.32
Level of Population (ln)	126/756	.02	.18

The predicted ratio comes from a Monte Carlo simulation which simulates data for 100 “countries” over 6 “periods” with “growth” and the rhs variables having different time series persistence. By varying the degree of persistence of rhs while holding the persistence of growth at .75 a tight predicted relationship with t-statistics is calculated.

Second, there is the well known problem from panel econometrics (pointed out early, and subsequently often, by Grilliches) that if the cross sectional variance of persistence is large relative to the time series variance and if the measurement error variance has a time series component, then the use of fixed effects exacerbates the degree of measurement error and

hence the attenuation bias. Especially with high persistence variables this effect can be enormous. Suppose the variance of measurement error were constant for each measurement while the true variation is mostly time persistent. The use of fixed effects with variables with persistence characteristics of those in table 8 could easily increase attenuation bias due to measurement error by a *factor of ten*.

The third problem is the dynamic misspecification involved in arbitrarily changing the time span over which the regression is estimated. This actually raises three problems with dynamics. The first is the *dynamic* mis-specification of the time scale over which the effects in various growth models operate. While some growth effects might take only several years, others might easily take decades. Arbitrarily parsing time series into shorter periods assumes the dynamics are invariant. Second, using the higher frequency components of variables whose time series have persistence implicitly assumes that the impact of *transitory* and *permanent* changes are exactly alike. In most dynamic macroeconomic models this is not true. The response to shocks of the same magnitude can be completely different, if one is perceived as permanent and other temporary. By taking out the “fixed” effect the data essentially only uses temporary innovations to identify coefficients, but this approach may completely miss important effect of permanent shifts.

Finally, by using only the smallish, transient deviations to identify parameters one must believe (probably to a psychologically unhealthy extent, but I’ll leave that to professionals) that the postulated model is not just roughlt, but *exactly* right. The growth impact of some variables might be different when occasioned by one underlying factor than by another. The impact of an increased fiscal deficit due to a terms trade shock leading to temporary revenue

falls might be different than that of a deficit caused by expenditure surges (say a defense buildup). Using long-period averages gives the coefficient on growth of the “typical” deficit. In contrast the use of only the high frequency assumes either that the temporary deviations have exactly the pattern of causes as the cross sectional variation or that the specified model is exactly right so that the growth impact is invariant. Either of those is highly implausible.

The combination of these three problems of lower power, increased attenuation bias, and dynamic misspecification mean that two of the common empirical findings from moving to higher frequency data are actually of very little use. One common finding that many cross sectional findings are not “robust” to the use of fixed effects, in the mechanistic sense that variables that are “significant” in the cross section using long period averages are not “significant” in fixed effect panels. For instance, while the long-period regressions typically find that the level of education or enrollment rates (conditional on initial income) is a significant determinant of subsequent growth (Barro and Sala-I-Martin, 1997), panel regressions typically find the level of education is insignificant (Islam, 1995)¹⁶. Similarly, new papers find that cross-sectional results on the negative impact of inequality on economic growth are not robust (even in sign) when one uses five year panels (Forbes, 1997).

Between the effects of lower power and larger attenuation bias a “failure to reject” with panels a coefficient found to be significant in longer periods is simply uninformative unless accompanied by both a serious analysis of power, say along the lines of Andrews (1989) and a serious analysis of measurement error.

¹⁶ The growth-human capital regressions that mix growth with levels or enrollment rates have their own, extremely serious, empirical and theoretical problems (Pritchett, 1996).

But certainly the models that propose a mechanism running from inequality to tax rates to investment to growth (Persson and Tabellini, 1994), or inequality to political instability to investment to growth (Alesina and Perotti, 1993), are not meant to be tested using a *contemporaneous* relationship between short-run deviations of growth from its long-term average and short-run deviations of inequality. The time scales for the channels whereby inequality affects growth require relatively long lasting shifts in growth, and relative long time periods (decades at least) for the impact to be manifest in increased growth.

The second empirical problem typically found with the use of the higher frequencies is that the regression parameters are not stable or “robust” over time. That is, if regressions are run decade by decade or even worse, five year period by five year period, it is common that the significant, and even sign of coefficients are not the same as using the averaged data. Kelley and Schmidt (1994) regress the growth of GDP per capita on population growth decade by decade and find a mildly negative coefficient in the 1960's, mildly positive in the 1970's, while in the 1980s the coefficient was larger and negative. Similarly, a recently published paper (Keefer and Knack, 1997) on social characteristics and growth shows substantial parameter instability as the regression on growth after 1980 finds a different sign for their “social” variables that regressions on growth prior to 1980, even though one would suspect that the underlying social characteristics changed only very slowly (they have only have a measure at one point in time). Similarly, one of the best researched findings in the growth literature is the connection between financial depth and characteristics of the banking sector and growth (Levine, 1997). However, this relationship shifts in decade by decade data.

Vamvakidis (1997) looks at the relationship between growth and trade over the very long-run with data going back into the 1900's and finds that the coefficient shifts over time.

So what? So *nothing*. The parameter instability that has been found so far is not particularly informative. The degree of parameter instability is hard to reconcile with *any* of the coefficients having identified a “true” invariant structural parameter that links growth at all frequencies: short, medium and long and other variables. But, how does one interpret these parameter shifts? Is the underlying structural relationship that produces the reduced form shifting? Does this reflect shifts in the temporary or in the steady state components of growth? Do these shifts reveal true strategic opportunities (it was good to be open in the 1960's but not the 1930's? It was good to be financially deep in the 1980's but not the 1970s?). But to make assertions of this sort about varying relationships between determinants and growth one would need not only to have a growth theory that establishes links between r.h.s.”stuff” and growth but much more. To make claims of this type one needs a theory that specifies not only what relationships are, but how these relationships shifts over time: otherwise with time varying parameters it is impossible to say which is the relevant parameter.

Low Persistence, high volatility variables. Now imagine a typical variable that, like growth has high volatility and low persistence over short to medium term horizons. In this case panel regressions face two different, but equally serious problems: endogeneity bias and structural mis-specification.

Endogeneity bias. A problem with very many “reduced form” growth regressions is that short panels exacerbate the endogeneity problem. That is suppose that there are long-run

growth (g_t) and business cycle (g_b) effects in the determination of current output for each country i at time period t .

$$y_t^i = y_{t-1}^i * (1 + g_t^i) * (1 + g_{b,t}^i)$$

Suppose there is a relationship that runs from the country specific average of an independent variable and long-run growth:

$$g_t^i = \beta * \bar{x}^i$$

But suppose that the average level of the variable x was determined as a “policy” choice but that there is a cyclical component to x that is driven by the “business cycle” component of growth (or both by some third factor, like political disruption, terms of trade shocks, etc.)

$$(x_t^i - \bar{x}^i) = \delta * g_{b,t}^i$$

Throwing some random disturbance terms into each of these equations and doing Monte Carlo shows (the obvious) that if one is trying to identify the long run growth impact, β , then moving from the long-run cross section to fixed effects on panels messes up completely. One can easily reverse the sign of β and instead of identifying the long-run of x on growth identify the short-run impact of growth on x .

This has implications for all types of growth regressions because, except for “structural” variables in the reduced form regressions, nearly all of the included right hand side variables are potentially endogenous, and for many of them there is reason to believe that the cyclical relationship may well be different than the long-run relationship. So for instance, imagine a

regression run between growth and budget deficit and imagine a country was pursuing a counter-cyclical fiscal policy. Then one could easily find a large negative growth “effect” of budget deficits that had nothing to do with long-run growth. Another example are regressions of foreign direct investment, since the level of FDI is highly responsive to current and expected growth in the recipient country then moving to shorter and shorter time periods exacerbates the endogeneity problems. This means one would expect to find a higher observed growth “impact” of FDI even if FDI had exactly to save returns as any other investment.

An even more likely possibility is that moving to fixed effects increases the bias due to omitted variables in the specification. Suppose there are shocks; wars or political disruption, terms of trade movements, adverse weather, that affect the functioning of the economy in a variety of ways and that these shocks are more highly correlated with the time series dimension of the included X variables than with the cross sectional variance.

Take variables like the black market premium, or inflation, or the fiscal deficit, or openness that I would call “semi-reduced” as they are themselves outcome variables. They are *not* strictly speaking “policy” variables as they are jointly determined by shocks and by policy responses to shocks. It is easy to tell a story in which an exogenous shock, like adverse terms of trade, or bad weather or political disruption could simultaneously affect output and these variables. For instance a large terms of trade shock in a commodity dependent country could simultaneously reduce government revenues (and hence increase the budget deficit if expenditures are not equally flexible), reduce export earnings and hence, unless the exchange rate regime was fully accommodating, decrease financeable imports by more than import demand and hence raise the black market premium, and lower observed “openness.” All the

while the shock itself may adversely affect actual (or measured) short-run GDP growth¹⁷. The point of long-period regressions is to smooth over these shocks. While simple averaging might not be the optimal filter, it is quite possibly better than no filter at all.

Now while it is true that in econometric theory these problems of joint endogeneity and possible even misspecification can be solved by finding adequate econometric estimation and adequate instruments. Perhaps this is a useful tack, particularly if it stimulates researchers to think hard about the underlying processes and discover new and clever instruments. However, so far most of the work has depended on more or less arbitrary restrictions on the time series properties of the data for identification. I am doubtful that GMM identified off dynamics is the solution and have been made more, rather than less, doubtful by the results produced so far.

IV) What have we learned, what would be helpful

What have we learned from reams and reams of growth regressions in which literally hundreds of variables have been place on the right hand side with growth rates on the left? A critical and skeptical reading of the Levine-Renelt (1992) paper on the robustness of the various partial correlation findings would suggest that these have taught us little or nothing¹⁸. However,

¹⁷ There are large unanswered questions about how in practice terms of trade are represented in existing national accounts.

¹⁸ The recent approach of Sala-I-Martin (1997) which criticizes the Levine-Renelt (1992) approach for being too stringent and calculating the fraction of regressions from which a variable is not significant think does not adequately address the multi-collinearity point. Suppose there are two equally important but unrelated syndromes which prevent growth. Suppose, for whatever reasons one of them has nine easily measured, but highly correlated, symptoms which will drive each other to individual insignificance while the other syndrome has only one measured symptom. Then in ten regressions the syndrome with one symptom will appear in all ten regressions and appear a "robust" growth correlate while each of the other syndromes symptoms will be "non-robust"

I take a much more positive tack and suggest that we have learned there are three growth diseases, or perhaps better said, anti-growth syndromes, to avoid. Syndromes have many associated symptoms that together help identify the problem, but the symptom is not the problem.

Most of the partial correlates that are included in growth regressions that are significant are so because they are symptomatic of the manifestation of one of these three syndromes in table 9. Each of the variables listed has been used in one or another in a growth regression.

appearing individually significant only when included with syndromes A's symptom. There is no mechanical or algorithmic solution to this problem.

Table 9: Anti-growth syndromes and their symptomatic manifestations in regression rhs variables	
Syndrome	Associated observable symptoms
Chronic or severe episodes of macroeconomic imbalance or instability	inflation, high fiscal deficits, black market premium, variance of inflation (or premia), foreign exchange or NTB controls, exchange rate over-valuation or variance, excessively negative real interest rates, financial market development indicators
Excessive inward orientation	trade barrier measures of various kinds, exchange rate overvaluation, foreign exchange controls, growth in volume or composition of exports, capital market controls, foreign direct investment, little movement or intellectual interchange, indices of "economic freedom", black market premia, "outward orientation" measures based on PPP.
State led development with a non-developmental state	corruption, quality of bureaucracy, negative (or zero) effects of government spending, political instability or "bad government" indicators, rule of law, low levels of health or education conditional on income, excessive income inequality, imposed socialist states, urban bias, excessive taxation of agriculture.

First, since many of the symptoms are overlapping within and across syndromes (many socialist economies were inward oriented, many non-developmental states had macro crises) the lack of the data to separately identify the individual contribution of each symptom (which is really the heart Levine-Renelt critique) is not that surprising (even if it is an important advance in understanding these regressions). If I know that high inflation and growth are negatively correlated then I also know that money supply growth and variance of prices and variance of

inflation are likely to be negatively correlated with growth too and I learn the same thing from all of them.

Second, the few really rapidly growing countries have avoided nearly all of these syndromes simultaneously and consistently, which again makes partialling things out quite difficult. The continued debate about trade policy in the East Asian miracle countries, where the question of just how “activist” and “interventionist” trade and industrial policy can be without being “inward oriented” reveals how difficult resolving these issues really is (Rodrik, 1997). Conversely, if one constructs a single binary variable encompassing many of these syndromes as Sachs and Warner (1996) have done, obviously it will work like gangbusters in a regression. This might suggest some kind of interactive effects where the absence of all syndromes can lead to much more rapid growth than if any one is present. An interesting recent paper by Ghosh and Wolf (1998) uses a flexible approach to the data, classification tree analysis, to categorize growth experiences without imposing the restrictions of multivariate regressions.

Episodes. Growth regressions as a tool are completely spent and moving to “panels” is unlikely to be of much use, and averaging over the whole period will miss many important phenomena entirely. For instance, Senegal’s growth was .18 ppa while Cote d’Ivoire’s was .22 ppa. However, Senegal had essentially this same growth rate the entire period, while CIV grew at 3.11 ppa up to 1980 and GDPPC fell at 4.11 after 1980. Certainly these are very different experiences and the one summary number fails to capture this. But dividing the entire period up into arbitrary 4 or 5 or 7 or 10 year bits and saying CIV had some positive and some negative and relating that to a predetermined set of X variables also does not seem promising.

There are three promising approaches to yield insights into growth.

First, the analysis of *episodes* of the initiation of growth acceleration or deceleration¹⁹. For each of the “plateau” “mountain” and “cliff” countries there is usually a quite easily identifiable downward turning point after which growth was much more rapid than before. Moreover, for many of the “steep hill” countries there is an identifiable “take-off” date after which growth was much more rapid. One strategy of research that seems promising is to examine the break points. Why did growth turn down or up so sharply around a certain date? Studies of this type of the growth take off in Korea in the early 1960s (Haggard et al, 1990) or in Mauritius 1970 (Romer,), or even Indonesia in 1966 or China since 1978 are extremely useful. Similarly, why did some countries hit periods of slow or negative growth and were unable to reverse the decline?

These studies can identify what the shifts were that accompanied the growth accelerations or decelerations. Not only that, they also could identify what the political conditions were that would make the adoption of such reforms possible or made adopting policies that would avoid a growth decline impossible (Rodrik, 1996).

The second type of useful study is analysis of the episodes of the evolution of possible growth determinants. For instance, in Bruno and Easterly's (1998) analysis of the growth impact of inflations shows that the impacts of inflation on growth are impossible to estimate from either long-period averages or from panels, but when one analyzes *episodes* of inflation

¹⁹ There is a rich economic literature in a number of fields relying on episodic analysis, both statistical and case study based. The studies on the effects of devaluation by Kamin (1988) and Edwards (1993) rely on identification of discrete devaluation episodes, the impact of debt crisis (), banking crises, and currency crises all rely on episodic analysis.

one finds clear and robust, if surprising, findings. Similarly, while now “ancient” by current standards the NBER study of exchange rate regimes and import liberalization episodes in ten countries by Bhagwati and Krueger has more insights and persuasive power than all growth regressions with “openness” as a rhs variable ever done.

The third high potential is some analysis of *changes* in growth rates over time. This is partly high potential because unexplored. In fact, when I wrote the first draft of this paper I could claim there had been no studies looking systematically at the determinants of *changes* in growth rates. However, Dani Rodrik’s (1997) new paper in which he does investigate how the change in growth between the early and later periods of the data. He shows that growth deceleration is determined by a combination of the shocks to the economy and their ability to adjust to those shocks, which was determined by social and political factors. I think his paper already shows the promise of the approach of investigating shifts in growth rates as well as levels.

Conclusion

There is something of a professional split by field in the “growth” literature. Economists who approach growth from having been developed country macro economists and move from “cycles” to “growth” tend to focus on the OECD countries. This leads them quite naturally to the happy puzzle of why growth has chugged along at around 2 percent per annum for a hundred years or more, with some mild interest in why some have had steeper hills than others, and ponder whether all in the “convergence club” will reach the same happy level in

the end. However, as growth theorists have always recognized this set of questions and methods about steady state growth are only of mild interest to non-OECD countries²⁰.

In contrast, development economists are the pathologists of economics. They deal with a much broader range of unhappy experiences. The growth experiences of LDCs are emphatically not all alike, and not just in how rapid (or slow) their average growth has been. The LDCs have found ways to be ecstatic, but have also discovered a broad range of ways to be unhappy.

²⁰ Hicks' *Capital and Growth* casually claims it is obvious that growth theory is the *least* relevant of all the fields of economics to the developing nations.

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